

Light + Learning

Open Scholarship on Learning, Design, and Technology, 2022

Royce Kimmons

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Foreword

The [*Instructional Psychology and Technology \(IP&T\) Department*](#) at *Brigham Young University* is a world leader in teaching and research in [Blended Learning](#), [Open Education](#), [Instructional Design](#), and [other areas](#). This volume is a collection of open-access articles written by faculty, students, alumni, and associates of the IP&T Department for the year 2021.

Graduate students in an *Introduction to Open Education* course taught by Dr. Royce Kimmons organized this volume and reformatted articles from their original publishing venues to showcase cutting-edge work. In addition, we have added new features to these articles to improve their quality and accessibility (e.g., text-to-speech).

By reorganizing these open educational resources into a single volume, we hope to provide a useful way for researchers and practitioners to gain information on how to more effectively teach, design, and learn with technology in both higher education and K-12 settings.

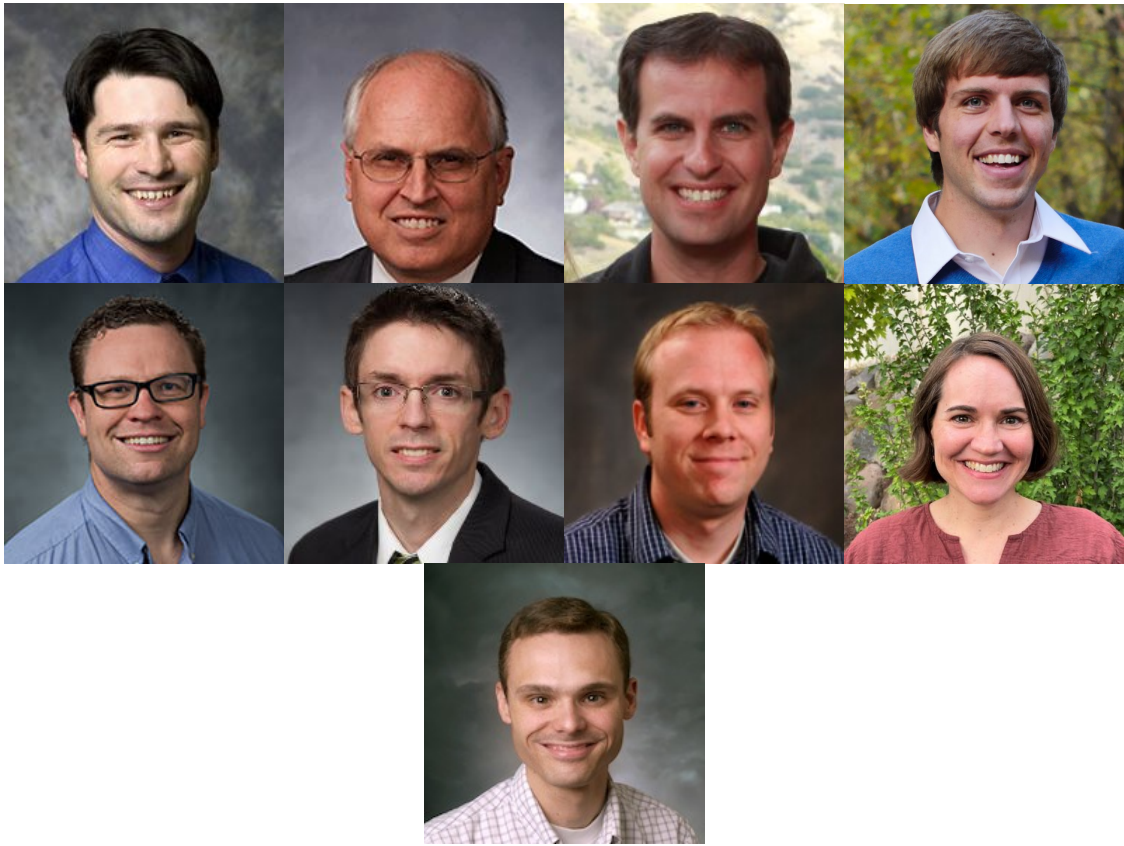
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Blended Learning

Back to Feedback Basics Using Video Recordings

Faculty Perceptions of Using Synchronous Video-based Communication Technology

The Handoff: Transitioning from Synchronous to Asynchronous Teaching

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Back to Feedback Basics Using Video Recordings

Jered Borup

Online Learning

Video

Asynchronous Online Course

Teaching and Learning

In order for students to learn effectively, feedback is essential. Providing feedback to students can have a huge impact on their learning. Instructors can provide their students with different types of feedback, including (1) webcam video, (2) screen recording, and (3) screen recording with webcam video. It is essential that instructors give quality feedback to students. Feedback should be timely, friendly, and specific. Videos can be used by instructors to provide feedback on assignments, not just on every assignment, but strategically so they can save time and improve quality.

Feedback is critical to students' learning. In fact, John Hattie's seminal research found that providing feedback is one of the most powerful things instructors can do to impact student learning. Feedback has always been a part of teaching and learning, but the internet has dramatically changed how students demonstrate their learning and how instructors provide them with useful feedback. Although text feedback is still the most common form in our digital world, instructors are increasingly providing their students with video-recorded feedback messages—for good reason.

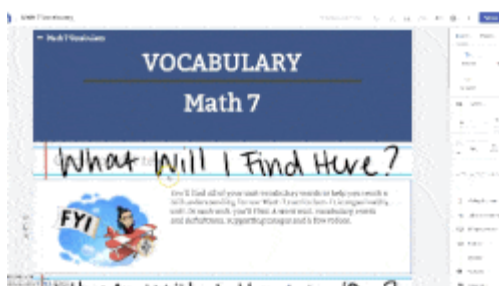
Types of Feedback Videos

You can provide video feedback to students in three ways: (1) webcam video, (2) screen recording, and (3) screen recording with webcam video (see examples below).

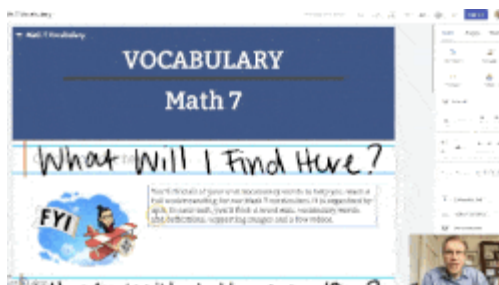
Webcam Only



Screen Recording Only



Screen Recording with Webcam



Each type of video feedback can be used for different purposes.

- **Webcam** videos are appropriate when you are providing feedback that doesn't require you to show student work. By only showing your webcam video, you can help students form a sense of connection with you and know that your goal is to facilitate their learning.
- **Screen recording** videos are appropriate when you need to show and verbally describe specific aspects of students work. For instance, if a student created a project, such as a website, image, or document, showing specific parts of the project as you are giving feedback—as seen in figure 1—can be an effective way to provide feedback. In these videos, students can see their work and hear the instructor's voice but can't actually see the instructor speaking.
- **Screen recording with webcam** videos combine the best of both worlds by placing a small webcam video within the screen recording video. With most tools, however, the webcam video is fairly small, so it can be difficult for students to connect with you, if that is your purpose. Furthermore, if you are not careful, the webcam video can cover up portions of the screen that you are trying to describe. Some tools allow you to change the size and location of the webcam or even remove it completely.

Regardless of the type of video that teachers use to provide feedback, the nature of recording a video allows them to provide more information to students. However, simply providing more feedback is unlikely to benefit students unless it is also quality feedback.

Quality Feedback, and How Video Can Help

Considering the amount of time instructors spend providing feedback, the topic is surprisingly under-researched. I echo Michael Eraut, who said "We need more feedback on feedback." When reviewing the research on feedback, my co-authors and I identified three elements of quality feedback. Specifically, quality feedback should be **timely**, **friendly**, and **specific** (see figure 2).



Figure 2. Characteristics of effective feedback

Using Video to Provide Feedback That Is Specific and Timely

The primary purpose of feedback is to improve student performance. However, not only should feedback highlight what students need to improve and how to improve it, but it should also affirm to students the specific strengths of their work. It's highly important that feedback comments be grounded in a student's actual performance. If not, it can harm their learning. For instance, if a student did poorly on an assignment but then got a "Great work!" comment, this feedback could reinforce low effort or poor performance, as seen in the following clip from the sitcom "Friends" when Joey was trying to learn French.



[Watch on YouTube](#)

What is Good Feedback?

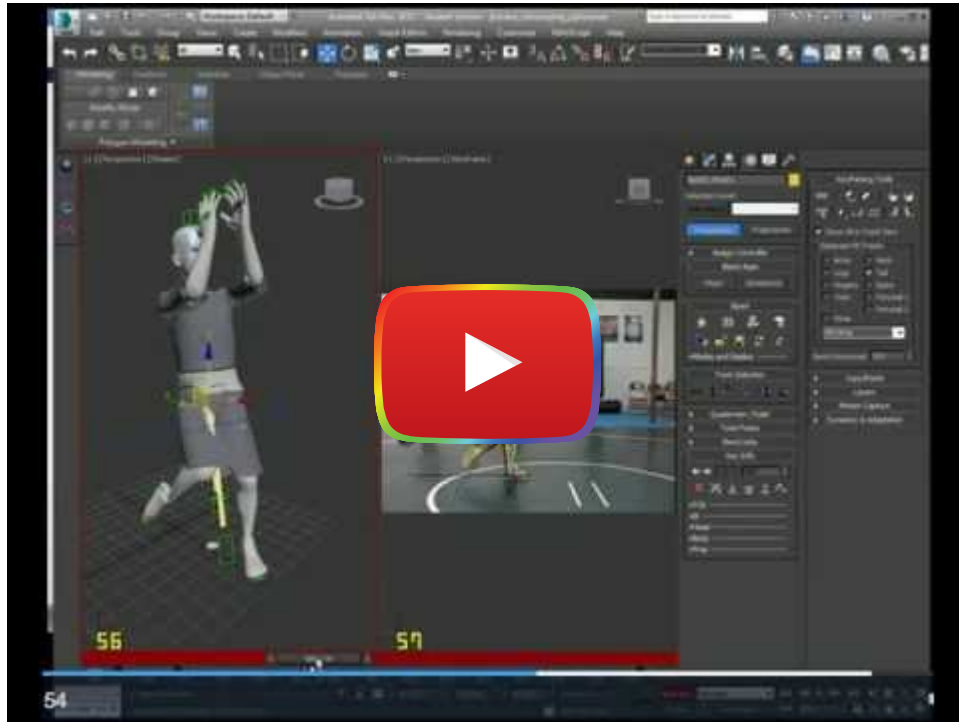
Providing feedback takes time. As a result, giving students comments that are both timely and specific can be a challenge. Too often teachers either provide quick, generic feedback or provide feedback that is specific but not timely. Having to pick one over the other can be frustrating for teachers. Furthermore, even when instructors take the time to review students' work thoroughly, if they only provide students with scores on a rubric and/or generic-sounding comments, students may question whether the instructors really reviewed their work at all, as in the video below.



[Watch on YouTube](#)

Mr. D

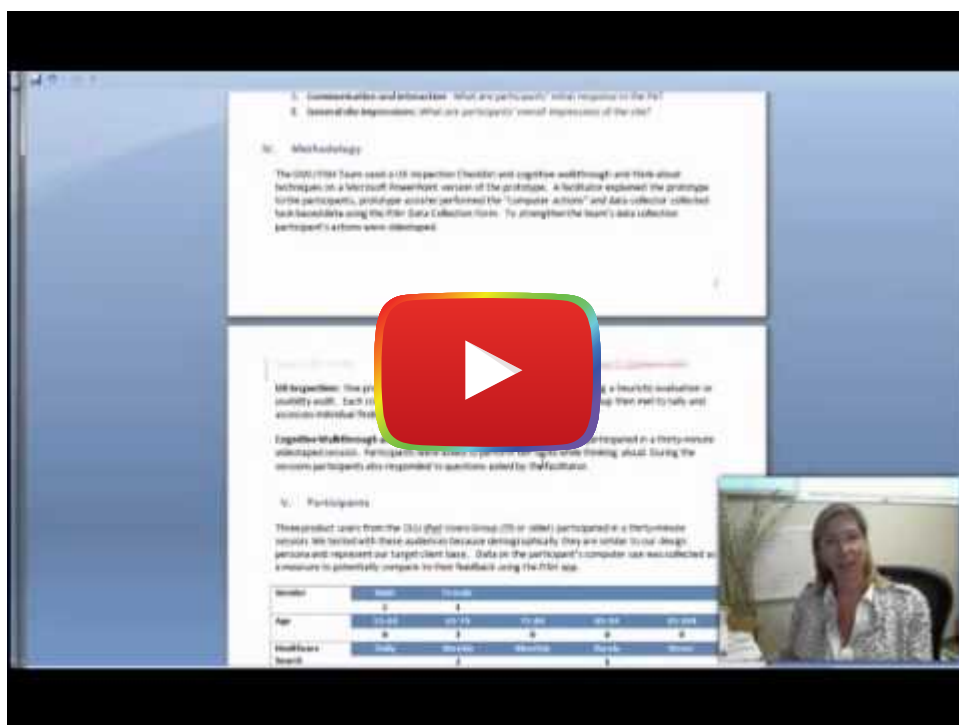
Teachers increasingly provide students with feedback via video in an attempt to give more-detailed comments that are rooted in students' specific work. Video comments can also be quicker than providing text feedback when the feedback needs to be detailed and unique to the student (i.e., when copying and pasting text comments would not work). Greg Grimsby at George Mason University provided the video feedback below, which shows feedback on a student's animation—this is a good example of the value of this kind of feedback. As you watch the video, imagine how difficult it would have been to give that level of detail in text.



[Watch on YouTube](#)

Example of Screencast Feedback

One drawback of providing feedback by video is that students might find it more difficult to refer back to specific parts of the feedback. This is especially important when students are asked to go back to their project and make revisions based on instructor feedback. In other cases, it just makes more sense to provide feedback in text. For instance, if an instructor is reading a student's essay and needs the student to add a comma in a sentence, the student does not need a video explaining that. As a result, in many cases we recommend that instructors provide feedback using some combination of text and video. For instance, if a student has submitted an essay in a word processing document, the teacher can track edits directly within the document but then provide a video feedback comment describing the overall strengths and areas that can be improved. Similarly, as you review students' work, you might jot down notes on what you would like to highlight in your video comment. If these comments are typed on your computer, you can easily send them to the student with a video comment that elaborates on those points.



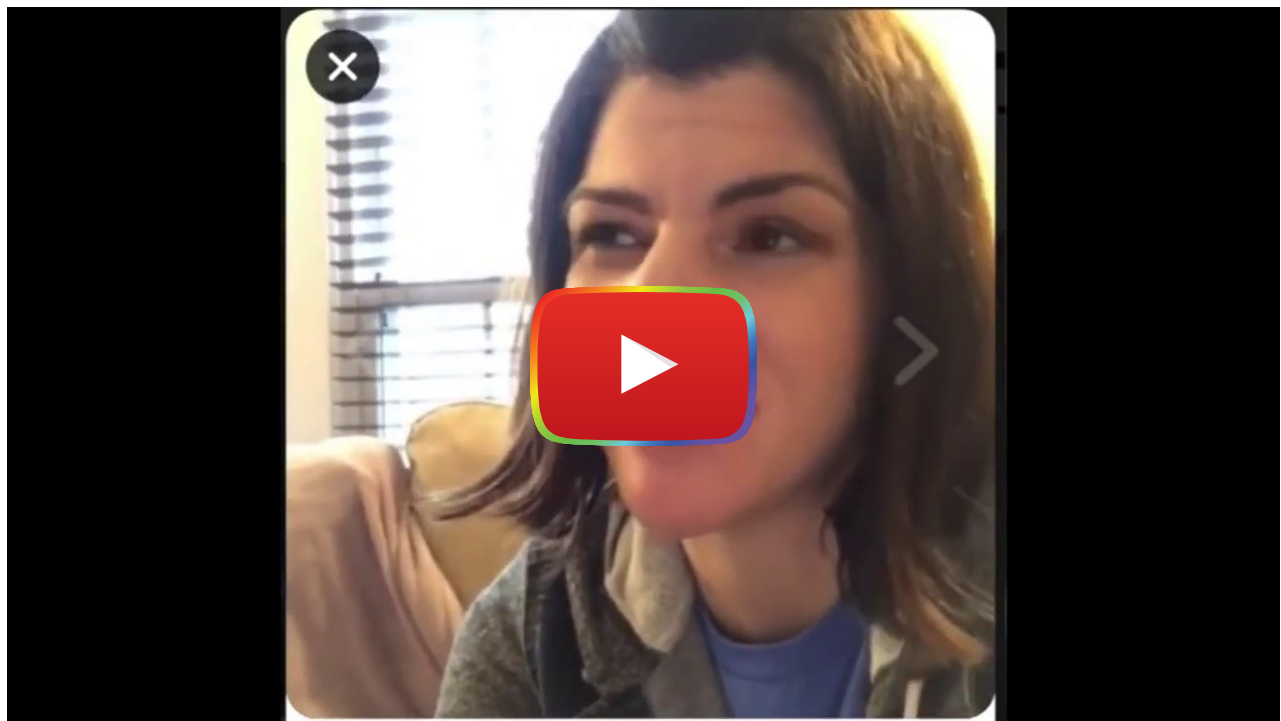
[Watch on YouTube](#)

Example of Screencast Feedback

Providing Friendly Feedback

Even though your feedback will likely correct students' work, it should be delivered in a friendly manner that strengthens rather than harms the instructor–student relationship. One drawback of text is that the recipient can misinterpret the meaning behind the message. In video, the instructor can communicate using facial expressions and body language that remove much of the ambiguity present in text-only messages. That said, if the instructor is trying to hide frustration or displeasure, text is a better choice because in a video, the student will see the frustration all over the instructor's face. Sometimes ending a sentence with an exclamation mark is easier than showing actual excitement.

In an online learning environment, friendly feedback is a great way to build relationships with others. In the following video you can see how Christine McLaughlin, a sixth-grade teacher, used video to correct her math students' pronunciation. The students had been posting videos defining various math vocabulary, and several had mispronounced the term "finite." She was kind in her correction while also showing her students a little bit of her world. It is a simple example but shows how video can be used to provide correction gently and in a way that strengthens the instructor–student relationship.



[Watch on YouTube](#)

FlipGrid Feedback Example

Video alone isn't enough to make our feedback friendly. We also need to structure what we say in a way that balances the praise with the critiques while still being social and friendly. One approach to ensure that your feedback is balanced and friendly is to apply the Feedback Cheeseburger. Notice that we added steam coming off the burger to emphasize that feedback burgers should be served quickly, while they are still fresh.



1. Bun—Relationship Building
2. Cheese—Specific Praise
3. Meat—Needed Corrections
4. Lettuce—General Praise
5. Bun—Support

Figure 3. Feedback Cheeseburger, created by the George Mason University's College of Education and Human Development Online Teaching Initiative (licensed under CC BY SA)

The following video is an example of a feedback comment that followed the model of the Feedback Cheeseburger. Notice that this video features Christine McLaughlin, the same teacher who provided the webcam video comment above. In this case she chose to provide feedback as a screen recording because she needed to highlight specific portions of the students' website.



[Watch on YouTube](#)

Example Screencast Feedback Following the Feedback Cheeseburger

Conclusion

Regardless of the context, quality feedback should be timely, friendly, and specific. At times this can be especially time consuming to provide online using only text, so we encourage instructors to consider how video messages could improve the feedback that they provide to students. The goal is not to use video feedback for all students on all assignments. Rather, instructors strategically use video when it likely to make the feedback more timely, friendly, and/or specific.

Acknowledgment

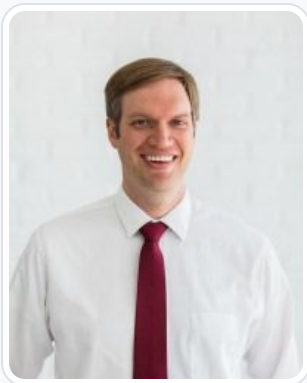
This chapter was written with the support of EdConnect and previously published at <https://books.byui.edu/-jNq>.

Notes

1. John Hattie, *Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement*, (New York: Routledge, 2009).
2. Michael Eraut, "Feedback," *Learning in Health and Social Care* 5, no. 3 (September 2006): 111–118.
3. Jered Borup, Richard E. West, and Rebecca Arlene Thomas, "The Impact of Text versus Video Communication on Instructor Feedback in Blended Courses," *Educational Technology Research and Development* 63, no. 2 (April 2015): 161–184.

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Faculty Perceptions of Using Synchronous Video-based Communication Technology

Patrick R. Lowenthal, Richard E. West, Leanna Archambault, Jered Borup, & Eric Belt

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Video

Teaching

Learning

Synchronous

Communication

Asynchronous Video

Online learning has traditionally relied on asynchronous text-based communication. The COVID-19 pandemic, though, has provided many faculty members with new and/or additional experience using synchronous video-based communication. Questions remain, though, about how this experience will shape online teaching and learning in the future. We conducted a mixed method study to investigate faculty perceptions of using synchronous video-based communication technology. In this paper, we present the results of our inquiry and implications for future research and practice.

The COVID-19 pandemic forced colleges and universities to move in-person courses online (Hodges et al., 2020). With little time, few resources, and often limited experience teaching at a distance, many faculty members opted to replace in-person class sessions with synchronous online meetings using web conferencing tools like Zoom (Lederman, 2020a, 2020b). This is not surprising. Over the last few years, faculty members increasingly attended or facilitated online meetings or webinars, familiarizing them with web conferencing tools like Zoom (Liu & Alexander, 2017). Further, replacing an in-person class with a synchronous online meeting requires little extra preparation. Research has also identified affordances of using synchronous meetings in blended and online courses such as improving immediacy, social presence, and a sense of community (Lowenthal et al., 2017; McDaniel et al., 2016; Martin & Parker, 2014; Park & Bonk, 2007). However, despite the convenience and possible benefits, there are constraints with the use (and overuse) of synchronous meetings. These include finding a convenient time, dealing with broadband and technical issues, and the tendency for synchronous meetings to turn into long lectures (Flaherty, 2020; Lederman, 2020b; Lowenthal et al., 2020).

Prior to COVID-19, many online educators, likely aware of some of the benefits and constraints, were resistant to using synchronous meetings in their online courses (Liu & Alexander, 2017; Themelis, 2014). Among others, Themelis (2014)

and Liu and Alexander (2017) found that a lack of institutional support and training on synchronous communication technologies created barriers to teaching from a distance, including reducing online educators' confidence, self-efficacy, and motivation related to synchronous technology. However, COVID19 and the requirement to teach and work from a distance, introduced faculty members to synchronous video-based communication technology for the first time and/or gave many others opportunities to experience it in new ways (Flaherty, 2020; Stewart, 2021). Questions remain, however, about how teaching and working from home might influence the ways faculty members will work and teach in the future, especially in regards to their communication and interaction with students and colleagues (see de Oliveira Dias et al., 2020; Kim, 2020; Pokhrel & Chhetri, 2021). Given this, we set out to investigate faculty perceptions of synchronous video-based communication technology. In this paper, we present the results of our study and implications for future research and practice. The research questions driving our inquiry were:

1. What are faculty perceptions of using synchronous video-based communication for personal use, teaching and learning, and for non-teaching work purposes?
2. Have faculty perceptions of using communication technologies changed as a result of the COVID-19 pandemic?

Literature Review

Evolution of Distance Education

While many instructors and students were first introduced to online learning as a result of COVID-19, distance education dates to the 1800s in the form of correspondence study where students worked through lessons on their own and then mailed them to be corrected (Bower & Hardy, 2004). In these early days, distance education focused on enabling learners to learn at any place and time. However, as technology advanced, educators increasingly used broadcasting methods, such as radio in the 1920s and television in the 1950s, for distance education (Casey, 2008; Saba, 2011). Broadcasting forms of distance education still focused on enabling people to learn from anywhere (i.e., assuming they had access to the broadcast), but did not center on learning at any time. Learner-instructor interactions were thus limited by few, if any, opportunities for learners to interact with their peers.

During the 1980s educators began exploring how to use computer networks and the internet to help people, even at a distance, learn together in ways previously unavailable in terms of more immediate communication between instructor and learner and new opportunities for learner-learner interactions (Harasim, 2000; Moore, 1989). By the 1990s, distance education had moved predominantly online. While the term "online learning" is used to describe the mode of communication, Garrison (2009) stressed that online learning and distance education have different core values. Specifically, distance education core values are access and flexibility while online learning's core values are collaborative learning and other constructivist approaches to learning.

These early online courses relied heavily, if not solely, on asynchronous text-based communication (i.e., email and discussion boards) and were often described as asynchronous learning networks (see Mayadas, 1997). Proponents highlighted the ability of people to learn from anywhere at any time while maintaining contact with other learners. While asynchronous online learning continued to grow and has since become the most common form of learning online, educators have continued to use broadcast methods as well as other forms of synchronous methods of communication (e.g., instant messaging, web conferencing) to teach and learn online (Finkelstein, 2006). Recently, Florence et al. (2020) defined the practice of combining synchronous and asynchronous online learning as bichronous learning. Online educators, though, need to understand the affordances and constraints of asynchronous and synchronous online communication and how best to strategically combine the two.

Asynchronous vs. Synchronous Communication

Various forms of online learning are often distinguished by how frequently instructors and students meet in person as well as the degree to which they rely on asynchronous or synchronous communication. For instance, Allen and Seaman (2007) distinguished between traditional, web facilitated, blended/hybrid, and online courses. A few years later, Sener

(2015) described seven types of courses: (1) classroom course, (2) synchronous distributed course, (3) web-enhanced course, (4) blended classroom course, (5) blended online course, (6) online course, and (7) flexible mode course. COVID-19 helped popularize a distinction between remote courses, where an instructor and students meet regularly online at a certain day and time (e.g., in synchronous sessions) and online courses designed to be completed primarily in an asynchronous format (Craig, 2020; Roe, 2020).

Affordances and Constraints of Asynchronous and Synchronous Communication

No communication medium is perfect but researchers spent the 1990s comparing various learning media for any inherent superiority. Those studies ultimately suggested that asynchronous and synchronous communication each have affordances and constraints, and that it matters more what one does with a communication medium than any inherent constraints (Hrastinski, 2008; Oztok et al., 2013). However, asynchronous communication was, and still is, the dominant form of communication in online courses (Oztok et al., 2013; Peterson et al., 2018). Asynchronous communication enables instructors and students to interact and communicate from any place or time. The flexibility in time inherent in asynchronous communication also affords the ability of time-independent access, equal opportunities to participate, improved peer interaction and participatory learning, time for reflection, and the ability to have in depth discussions over time (Garrison et al., 2000; Graham, 2006; McDonald, 2016; Oztok et al., Faculty Perceptions of Synchronous Video Online Learning Journal – Volume 25 Issue 4 – December 2021 77 2013). Despite these benefits, asynchronous text-based communication has been criticized for the time it takes conversations to develop, its lack of spontaneity, being too task-based, offering insufficient opportunities for social interactions, creating a sense of isolation or separation between participants, and delaying communication and feedback (Graham, 2006; Hrastinski, 2008; Huang & Hsiao, 2012; Romero-Hall & Vicentini, 2017). Further, criticisms of online learning often focus on the absence of body language and visual cues in asynchronous text-based communication (Lowenthal, 2010).

Educators have been attracted to synchronous communication, and specifically synchronous video-based communication, because it most closely resembles in-person communication (Lowenthal et al., 2020; Romero-Hall & Vicentini, 2017). More specifically, researchers have argued that synchronous sessions help improve teacher immediacy, improve interaction and student participation, and enable spontaneity (Hrastinski, 2008; Olson, 2015; Park & Bonk, 2007; Parker & Martin, 2010). However, synchronous communication also has constraints, many of which were identified long before COVID-19. For example, it can be difficult in synchronous meetings to enable equal participation. Such meetings are prone to distraction, can be plagued by technical difficulties, and often have privacy and security issues (Bali, 2016; West & Borup, 2021; Means & Neisler, 2021). Bali and Meier (2014) even argue that synchronous meetings can be biased and culturally unaware, and can favor those with flexible time schedules, who live in popular time zones, have reliable wifi, and possess linguistic capital. These constraints have been amplified in various ways during COVID-19 with the increased day-to-day use of synchronous meetings. However, this increase has also resulted in people suffering from “Zoom fatigue” (Caines, 2020; Schulman, 2020).

Changes in Perceptions and Use Over Time

Perceptions of asynchronous and synchronous communication have evolved over time. During the late 1990s and early 2000s, online educators often questioned the need and value of synchronous communication (see Palloff & Pratt, 1999). But by the mid-to-late 2000s, as web conferencing applications and broadband improved, a growing group of online educators began experimenting more with using synchronous communication, often in primarily asynchronous online courses (Hrastinski, 2008; Hrastinski et al., 2010; Park, & Bonk, 2007). By 2014, Cornelius (2014) and Martin and Parker (2014) both noted the increased use of synchronous meetings in higher education. More recently, Lemos dos Santos and Cechinel (2019) found that instructors and students had a clear preference for asynchronous communication tools but synchronous communication tools also received high rankings. Following these perceived preferences, educators have increasingly used synchronous meetings as a supplement to asynchronous learning activities, although perhaps not as much as some might have predicted, considering their widespread availability. This lack of widespread use, prior to COVID-19, could have been due in part to a lack of opportunities and training to learn how to effectively use synchronous meetings (Grant & Cheon, 2007; Martin & Parker, 2014). However, Ertmer’s (1999)

framework on obstacles to change highlights that the lack of training is only one of several reasons why instructors fail to adopt new teaching practices, even when those practices have the potential to positively impact course outcomes and that a more deeply rooted obstacle is faculty's beliefs, attitudes, and dispositions that can make them especially resistant to new ways of teaching and learning.

Faculty Resistance to Online Learning and Unintended Consequences of COVID-19

Enrollments in online courses and programs in higher education continued to grow during the last decade (Allen & Seaman, 2017). Before COVID-19, a third of students took at least one Faculty Perceptions of Synchronous Video Online Learning Journal – Volume 25 Issue 4 – December 2021 78 online course each year (Allen & Seaman, 2018; Lederman, 2018). Despite the growth in online learning, the majority of faculty remained skeptical of online learning and even resisted teaching online (Jaschik & Lederman, 2016; Lloyd et al., 2012). The literature suggests that faculty may resist teaching online because of concerns about interaction and student outcomes, lack of institutional support, training requirements, workload concerns, and fear of losing control (Allen et al., 2012; Lloyd et al., 2012; McGee, et al., 2017; Ubell, 2017). At the same time, research also suggests that these concerns are less prevalent with faculty members who have prior experience teaching in blended and online learning formats (Hunt et al., 2014; Lloyd et al., 2012).

While COVID-19 has been disruptive to the field of education, it forced nearly every educator to gain some general experience with digital instruction, if not specifically with remote or online teaching. Before COVID-19, instructors like Christopher Schaberg (2018) boldly claimed “I’ll never teach online.” However, during COVID-19, many instructors like Schaberg (2020) chose to teach online even when they could teach in-person. And still others, such as Eric Mazur, an “active-learning evangelist” and “teaching celebrity,” now question whether teaching online might even be better than teaching in-person (McMurtie, 2021).

In summary, distance education has evolved over the years. Even before COVID-19, colleges and universities offered several types of blended and online courses. While these blended and online courses tended to rely on asynchronous text-based communication, instructors have used synchronous sessions in various ways. During the pandemic, nearly every faculty member had an opportunity to work and teach from a distance, often using synchronous sessions in unprecedented ways. These new experiences may change online learning and the nature of faculty work in the future. However, additional research is needed to find out how these experiences might have influenced faculty perceptions of synchronous meetings as well as their perceptions of blended and online learning.

Method

After receiving Institutional Review Board approval (protocol 101-SB20-103), we conducted an explanatory, two-phased, sequential, mixed-methods study (Onwuegbuzie & Leech, 2005). This research design was used so that follow-up interviews could help explain or elaborate on the results from the first phase of the study. We were interested in a better understanding of faculty perceptions of synchronous video-based communication technology.

Data Collection

We created an online survey using Qualtrics to collect data during the first phase of the study. The survey included a series of Likert-style questions (on a 5-point scale) as well as openended questions that provided an opportunity for participants to explain their responses and to take part in a follow-up interview (a copy of the survey and interview questions are in the Appendix). The survey was administered via Facebook, Twitter, and various professional organizations (e.g., WCET, EDUCAUSE, AERA AECT, SITE), as well as to all faculty members at two Colleges of Education where two of the researchers work. A total of 336 people completed the survey.

The second phase of the study involved follow-up interviews. A total of 40 participants agreed to be interviewed. From this list, we randomly selected 15 participants to interview but added 3 additional interviews (for a total of 18) due to

delays in setting up the original interviews. The semi-structured interviews were conducted by Belt and recorded in Zoom.

Data Analysis

Descriptive statistics were calculated for the quantitative survey questions. The qualitative data from the open-ended survey questions were analyzed using a constant comparative technique (Leech & Onwuegbuzie, 2007) which essentially involved using a multistage coding process of descriptive and pattern coding to code and analyze the data (Saldana, 2016). Descriptive coding “summarizes in a word or short phrase—most often as a noun—the basic topic of a passage of qualitative data” (Saldana, 2013, p. 88). Pattern coding is a way of grouping those summaries into a smaller number of sets, themes, or constructs (Miles & Huberman, 1994). Then the recordings from the follow-up interviews were transcribed and coded following the same multistage coding process.

Positionality, Trustworthiness, and Credibility

The first author, Lowenthal, initially conceived of the study. While he collaborated with his co-authors to create the survey and interview questions, conduct the study, and write up the results, he oversaw qualitative data analysis. He is an experienced researcher and an online educator since 2003. He has interest in, and experience with, various teaching and learning communication technologies. However, he also believes that no communication technology is inherently better than another, and that video is not a panacea and should be used intentionally and selectively (see Belt & Lowenthal, under review; Belt & Lowenthal, 2021; Lowenthal, under review; Lowenthal, 2021; Lowenthal et al., 2020; Lowenthal et al., 2022; Lowenthal & Moore, 2020). He approached this study with an interest in better understanding how faculty experiences during COVID-19 might influence their perceptions and future use of synchronous video-based communication technology and, in turn, its influence on the future of online learning.

Lowenthal initially analyzed the qualitative data from surveys and interviews after Belt conducted the interviews. He compared the data and themes that emerged from both the surveys and the interviews as a form of triangulation. Then, following the advice of Elo et al. (2014), who explained that “a good qualitative researcher cannot avoid ... returning again and again to the data, to check whether the interpretation is true to the data and the features identified are corroborated by other interviews” (p. 5), he returned to the data three months after the initial analysis, and with questions prompted by his co-authors, to double-check his analysis and in turn improve the reliability and credibility of the initial analysis.

Findings

Phase One: Survey Results

Part One: Demographics

Participants’ teaching experience in higher education ranged from 1 to 30 years, with an average of 12.7 years (SD=8.1); their experience teaching blended or online courses in higher education ranged from 1 to 26 years, with an average of 8.12 years (SD=6.0). We asked participants how frequently they used synchronous video-based communication before COVID19 in other parts of their lives (see Table 1). We found that participants who might be described as “regular users” (i.e., those who use it daily, weekly, or monthly) used synchronous meetings more for work not focused on teaching as well as for their personal life and less for teaching. However, over 28% had rarely or never used it for work not related to teaching and over 45% had not used it when teaching a blended or online course prior to COVID-19.

Table 1

Synchronous Video-based Communication Use Before COVID-19

Before COVID-19, how frequently did you use synch. comm.	Daily	Weekly	Monthly	1-2 times a semester	Rarely	Never	n
Personal life	16 (4.8%)	68 (20.5%)	61 (18.4%)	32 (9.7%)	102 (30.8%)	52 (15.7%)	331
For work not teaching	32 (9.6%)	95 (28.6%)	68 (20.5%)	43 (13%)	66 (19.9%)	28 (8.4%)	332
Teaching a blended or online	18 (6.4%)	66 (20.2%)	38 (11.6%)	54 (16.51%)	50 (15.3%)	98 (30.0%)	324
When teaching F2F	6 (1.9%)	13 (4.1%)	10 (3.1%)	36 (11.3%)	85 (26.7%)	168 (52.8%)	318

Part Two: Satisfaction

Once we knew how often participants used synchronous meetings in different aspects of their life, we wanted to know how satisfied they were teaching blended and online courses before COVID-19 and specifically how satisfied they were with using synchronous video-based communication during the pandemic. Overall, 76% of participants (who had taught blended or online courses before COVID-19) were somewhat or extremely satisfied with teaching blended or online courses. Similarly, 76% of participants reported that they were either somewhat satisfied or extremely satisfied with using video-based communication in their personal life, 77% were either somewhat satisfied or extremely satisfied with using it for teaching and learning, and 85.5% were either somewhat satisfied or extremely satisfied with using it for work not related to teaching and learning (see Table 2).

Table 2

Satisfaction With Teaching Blended / Online Courses Before COVID-19 and Use of Synchronous Video-based Communication During COVID-19

	1 Extremely dissatisfied	2 Somewhat dissatisfied	3 Neither satisfied nor dissatisfied	4 Somewhat satisfied	5 Extremely satisfied	M	SD	n
Before COVID-19, how satisfied were you teaching blended/online? *	7 (2.4%)	31 (10.4%)	34 (11.4%)	114 (38.4%)	111 (37.8%)	3.98	1.06	297
Currently, how satisfied are you with synchronous video-based communication...								
in your personal life	6 (1.8%)	20 (6%)	53 (15.9%)	136 (40.7%)	119 (35.6%)	4.02	0.96	334
for teaching and learning	6 (1.8%)	29 (8.7%)	42 (12.6%)	178 (53.5%)	78 (23.4%)	3.88	0.93	333
for work not related to teaching	2 (0.6%)	12 (3.6%)	35 (10.4%)	141 (42%)	146 (43.5%)	4.24	0.82	336

*Note: 38 or 10% of participants had not taught blended or online prior to COVID

We then asked participants to explain their responses related to their current use (see Table 2). Six themes were identified from the data from this question (see Table 3). We briefly discuss each below and include some verbatim quotations from various respondents.

Convenience and Flexibility.

Participants reported that they were happy with the convenience and flexibility of using synchronous video-based communication. They specifically liked not having to drive to campus for meetings and the convenience and flexibility this type of communication can provide.

I honestly love working from home and not...traveling...to attend things in person. This has made my work life far less taxing.

The way synchronous time is used makes a huge difference. Shorter synchronous time is better...

Overuse and Fatigue.

Participants consistently commented on the overuse of synchronous video-based communication and the fatigue that they can feel from spending hours at a time in meetings.

I actually have more meetings now over Zoom than I used to when working in the office. I think we've adopted the mentality that since we can't pop in and talk in the office, we need to schedule extra meetings, but it's left me...exhausted and Zoomed out (something that's no doubt exacerbated by having two small children at home).

I'm definitely feeling Zoom fatigue in both my professional and personal life.... I don't feel eager to use it in my personal life largely because I'm using it so much for work...it beats the alternative of not being able to work/collaborate remotely...my beef is with the pandemic more than with Zoom.

Personal video calls are becoming tiring due to doing so many of them in the pandemic. I wish that we didn't have to do them and could just meet in person. My distaste is emotional, not technical; the technology is fine, I just tire of it.

User Interaction, Engagement, and Multi-tasking & Distraction.

Another theme focused on the lack of user interaction, engagement, and multitasking, and the distraction that takes place in these meetings. Participants pointed out problems and the frustration of being in meetings where group members have their cameras off, seem disengaged, and appear to be doing other things. This theme is illustrated in the following quotes:

*It's not bad, but I miss actually SEEING the people...I am frustrated with students not turning on their cameras (even though I completely understand why, and I respect their right to *not* turn them on). But still, I don't like that, to be honest. In committee meetings: I don't mind online meetings. Saves time. I have a hate on for admin work recently.*

One-on-one or small group video chats with friends and family work well—everyone is happy to participate, we get to see each other.... With teaching, the students mostly have black screens and are reluctant to participate. For work, it's fine...where I am not expected to participate, I often turn off video and fold laundry or go for a walk (I realise [sic] my students may think of video classes in these terms)—there are a few questions after such lectures, but it might almost just as well have been pre-recorded.

Learning Curve and Technical Issues.

Consistently, participants identified a learning curve, both in terms of comfort with the technology and with its effective use. In addition, participants described how institutions must continue to find ways to support faculty and student use of this type of communication because, regardless of one's skills and abilities with the technology, technical problems arise (sometimes due to students' lack of knowledge) that can derail a lesson and even be emotionally taxing. Here are several perspectives:

I still feel like I lack the skills to effectively foster quality discussions where everyone feels involved in class (teaching). Similar feelings for hosting large- and medium-sized family/personal groups. It always feels just a bit awkward and like there are some who are not speaking up. Also, I'd like to learn how to use various other tools...but I feel like I just don't have the time or energy.

In a research collaboration context, it's easier to navigate minor technical hiccups, and because there are fewer of us, they don't happen very often. In a teaching context, it's very stressful to manage the experience of 20-50 students...technical glitches are emotional. They mean missing important parts of the story or key events. It's worse to have a bad connection than to not have participated remotely in the first place.

With family it's even worse. God bless my in-laws and their complete inability to remember how to log on from one weekend to the next. By the time we are all connected, I'm so irritated I don't even want to be online anymore.

Context, Purpose, People, and Technology.

The last theme focused on how many things can impact the effectiveness of a synchronous meeting. Participants pointed out how they thought synchronous meetings worked better for smaller groups and shorter meetings than larger groups and longer meetings. They also mentioned that they thought they worked better when people wanted to be there, wanted to participate and contribute (e.g., committee work), and had a previously established relationship with other attendees. And finally, the effectiveness of synchronous meetings can be impacted by the platform, as some participants clearly preferred some platforms over others. The following quotes capture some of these ideas:

I find it very difficult to...connect to my students, especially those I have not met in faceto-face contexts. For research & admin purposes—these are...people I have likely met before and already have a connection to.

I think meeting online is necessary but not ideal for building relationships.”

Zoom works well for small meetings or large webinars, but the middle ground of classroom-like gatherings isn't perfect. It takes so much energy to corral more than seven people on a Zoom meeting, and it ends up being less discussion, more presentation.

Zoom works well for small meetings with colleagues that are both interested in the subject matter and willing participants in the meeting.... From my limited experience, Zoom synchronous online teaching (any class over 20 students) with tools like Zoom is a dark pit where students just sit there zoning out; not participating and generally wasting their time.

Table 3

Themes of Factors That Influenced Satisfaction

Convenience and Flexibility	Participants repeatedly reported that they like how video-based synchronous technology enables them to work from a distance, especially during a pandemic, and the ability to connect with friends, family, and colleagues from all over the world.
Overuse and Fatigue	Participants mentioned how the convenience and flexibility of video-based synchronous technology has resulted in more meetings, with many faculty being required to add synchronous meetings to their “remote” courses. The increasing number of synchronous meetings has resulted in what many referred to as “Zoom fatigue.”
User Interaction, Engagement, and Multi-tasking & Distraction	Participants pointed out challenges of ensuring every participant is able to interact and are engaged during video-based synchronous meetings or classes; common practices of turning

	one's camera off or multitasking during work meetings or class can lead to distraction or the instructor's inability to check student understanding.
Learning Curve	Participants noted that there is a learning curve to effectively using video-based synchronous technology and that faculty and students, as well as friends and family, need time, experience, and resources to be able to effectively use these communication tools.
Technical Issues	Participants repeatedly pointed out how technical issues, whether they be due to bandwidth issues (including audio and visual latency issues), platform technical glitches, or user error, can influence how satisfied they are with video-based synchronous technology.
Context, Purpose, People, and Technology	Participants also pointed out that the context (e.g., group size, length), the purpose (e.g., socializing vs. committee work; office hours vs. full class), the people (e.g., with a previously established relationship), and the technology influenced their level of satisfaction with using video-based synchronous technology.

Part Three: Satisfaction with Other Communication Technologies

Once we had an idea about how satisfied participants were with synchronous video-based communication, we wanted to better understand how satisfied they were with using other communication technologies when teaching blended or online courses. Not surprisingly, participants expressed highest satisfaction with email (M=4.06) but synchronous meetings/discussions were a close second (M=3.96). Phone calls (M=3.40), text messaging (M=3.50), and group messaging (M=3.50) received the lowest ratings (see Table 4).

Table 4

Satisfaction With Different Types of Communication Technology When Teaching Blended and Online Courses

	1 Extremely dissatisfied	2 Somewhat dissatisfied	3 Neither satisfied nor dissatisfied	4 Somewhat satisfied	5 Extremely satisfied	M	SD	n
How satisfied are you with using when teaching blended or online courses?								
Email	10 (3.2%)	12 (4%)	39 (12.4%)	143 (45.5%)	110 (35%)	4.05	0.96	314
Phone call	22 (8.5%)	36 (14%)	80 (30.9%)	64 (24.7%)	57 (22.0%)	3.38	1.21	259
Text message (to one person)	19 (8%)	26 (11%)	66 (27.7%)	76 (31.9%)	51 (21.4%)	3.48	1.18	238
Group text or messaging (e.g., Slack)	15 (6.7%)	18 (8%)	74 (33.2%)	77 (34.5%)	39 (17.5%)	3.48	1.08	223
Asynchronous text-based discussions (e.g., in an LMS)	12 (3.8%)	40 (13%)	36 (11.4%)	144 (45.7%)	83 (26.3%)	3.78	1.09	315
Asynchronous video-based discussions (e.g., Flipgrid)	4 (1.7%)	13 (6%)	75(32.8%)	92 (40.2%)	45 (19.7%)	3.70	0.91	229
Synchronous video-based discussions (e.g., Zoom)	6 (1.9%)	25 (8%)	27 (8.7%)	175 (56.1%)	79 (25.3%)	3.95	0.91	312

Part Four: COVID's Influence

We then investigated how participants experienced social distancing and how working and teaching at home might influence their future use of synchronous video-based communication. Participants overall reported that they were more likely to use video-based technology in all facets of their life after COVID-19 (see Table 5). However, there was even stronger agreement when asked about using it for work not related to teaching ($M=4.19$) and when teaching a blended or online course ($M=4.06$).

Table 5

Likelihood of Future Use of Video-based Communication

	1 Extremely dissatisfied	2 Somewhat dissatisfied	3 Neither satisfied nor dissatisfied	4 Somewhat satisfied	5 Extremely satisfied	M	SD	n
To what degree do you agree with the following: Once the COVID-19 pandemic ends, I'm more likely to use synchronous video-based communication (e.g., Zoom, WebEx)... than before the pandemic								
- in my personal life (e.g., talking with friends or family)	23 (6.9%)	44 (13.2%)	59 (17.7%)	113 (33.9%)	94 (28.2%)	3.63	1.22	333
- for work not related to teaching and learning (e.g., research collaboration, advising, committee work)	6 (1.8%)	13 (4%)	44 (13.4%)	114 (34.8%)	151 (46%)	4.19	0.94	338
- when teaching a blended or online course	11 (3.4%)	21 (6.4%)	51 (15.6%)	99 (30.4%)	144 (44.2%)	4.06	1.08	326
- when teaching a traditional face-to-face course	45 (14.5%)	41 (13.2%)	78 (25.1%)	93 (29.9%)	54 (17.4%)	3.23	1.29	311

We then asked participants to explain their answers about their future use. We identified five themes, listed in Table 6, discussed briefly here.

More Likely to Use for Work.

Echoing the results in Table 5 and certain themes from earlier, some participants described how they were more likely to use video-based technology for work that was not focused on teaching. As participants gained more experience with synchronous meetings at work, they grew to appreciate the increased comfort and/or efficiencies of attending work or advising meetings online. The following quotes capture this sentiment:

Previous beliefs that working and collaborating face-to-face were more effective...have shifted dramatically. We have learned that online, synchronous communications are just as effective. We can...can accomplish the same, if not more, working...online instead of spending time to commute. Additional benefits...less pollution, less time wasted in traffic...less overhead...

For work, I will continue to use synchronous video-based communication for everything—as much as I can. I find it effective and flexible. Also considering the state of the world, I do not feel comfortable venturing out into public anytime soon.

Now that more people are familiar with Zoom and WebEx, I will likely recommend using it, especially when busy schedules and geographic differences impede meeting in person.

More Likely to Use for Teaching.

Other participants expected to use more video-based technology for teaching in the future, citing immediacy, flexibility, and the ability to check-in as needed as reasons.

Zoom has proven to be an effective tool. As such, I am considering using it in conjunction with traditional face-to-face classes.

My online asynchronous students are demanding the use of synchronous instruction—I imagine my F2F students will seek more of this as well.

I asked my 100% online students if they would like me to hold an optional synchronous hour each week and they said yes. So, I am implementing this for the first time in the fall.

Unsure or Undecided About Future Use.

Some participants expressed uncertainty about future use since they were unsure of what their university, colleagues, and/or students will expect in the future. and when the pandemic will end.

Well...it depends on many factors. So, we'll have to see.

These decisions are not ours to make. It was not up to us to shift everything online...and it will not be up to us...how things will work once the crisis ends, if such a day ever comes.

I think it will depend on how the structure of the university and the expectations of students change as a result of the pandemic.

No Change.

Some participants had been using synchronous meetings long before COVID-19. They therefore claimed that their experiences using it during the pandemic will not likely change how they use it after COVID-19. They highlighted the importance of taking a balanced approach as captured below:

I don't foresee anything changing with my use of video conferencing. I use it regularly already and will continue to do so.

I have used synchronous teaching for my courses since 2013. I will not be using this technology any more or any less.

Likely Less Use.

Some participants clearly expressed a desire to either take a break from video-based technology or to perhaps never have to use it again. They preferred to be back in the classroom and teaching in ways that they think do not require synchronous meetings:

These tools work well, but I look forward to using them less.

I am very uncomfortable with the technology; my students' access has been unreliable and inconsistent, and I simply do not like it.

*I will only use Zoom for work when I 100% have to. I *will not* use video conferencing solutions if I can teach or meet in-person for better experiences.*

Remote/online learning are manifestly inferior ways to teach my subject. I will not do so once classroom instruction is available again.

Table 6

Themes About Future Use of Video-based Communication

More likely to use more for work not directly focused on teaching	Many participants explained that they were likely to use synchronous video-based communication more for meetings, committees, and student advising than before COVID-19 either because of people's increased comfort and/or the increased efficiencies (e.g., flexibility, less commuting, more efficient).
More likely to use more for teaching	Other participants explained how they were likely to use synchronous video-based communication specifically more for teaching, whether that be with face-to-face, blended, or online courses due to its advantages.
Unsure or undecided about future use	Some participants stated that they were unsure about their future use either because they were unsure about future pandemics, university requirements, subjects taught or class size, or people's general need to take a break from video-based communication.
No change on use	Some participants reported that they plan to use it just like before as needed, taking a balanced and intentional approach or because they are heavy users.
Likely less use	Some participants stated that they plan to use it less because they simply dislike it, they prefer in-person communication, and/or that they simply need a break.

The last question on the survey asked participants about how their experience working and teaching from home during COVID-19 influenced or changed their perceptions of using communication technologies for teaching at a distance. Three themes emerged from the data (see Table 7). While this question was specifically focused on using various communication technologies when teaching at a distance, most participants focused on whether using synchronous meetings had changed their perceptions. A few faculty members mentioned their increased concerns regarding communication technologies

Improved Perceptions.

Many participants reported that working and teaching from home forced them to learn how to use various technologies almost overnight. While many still faced challenges and expressed a need to learn more, the experience helped build their confidence. They were surprised at how flexible and convenient certain teaching and learning tasks were and were inspired with how they might teach differently moving forward.

I see these tools as a real blessing! Is it 'the same' as being in the same room with my students? No. But... continuing learning in these flexible ways has been pretty incredible. I've become convinced that breathing the same air should not be the measure of a highquality learning experience.

It's easier and more efficient than I imagined.

Improved my likelihood of teaching courses online in the future and learning more." "I am much less opposed to online learning than before because Zoom allows for a better online experience

Conflating online courses with asynchronous delivery was a mistake. From now on, all my courses, regardless of delivery method, will include synchronous, and likely, online video conferencing.

It has massively broadened my horizon as to the options and advantages, and I will keep using these new tools I learned about.

Did not change perceptions.

At the same time, other experienced educators familiar with various communication technologies as well as those who already had strong feelings about the superiority of face-to-face communication reported that COVID-19 did not really change how they thought about using communication technologies for teaching and learning.

Absolutely not. These tools are identical now as they were in January 2020.

Pretty much the same but I like to see that ... others are more open to using tech for meetings.

I still believe that online teaching, while sometimes necessary, is never as good as the real thing.

Increased concerns.

Finally, a small group reported that they now have increased concerns about the use of communication technology for teaching and learning. They found that rather than bring people together, these tools can be divisive and highlight issues of equity and access.

The pandemic has highlighted for me the inequities that face our students and the need for us as faculty to accommodate our students needs to create more equitable learning environments. Reliable internet, adequate hardware and adequate computer skills are just some of the basic areas that students need more support.

Makes me realize how poor they are.

Synchronous learning disadvantages female staff...[with] caring responsibilities...and disadvantages students who live in multi-generational households and have caring responsibilities. Asynchronous learning is fairer and more equitable as it enables all parties involved to participate at a time that suits them—which is often late in the evening when other members of the household are in bed.

Table 7

Themes About How COVID Changed Perceptions About Communication Technologies

Experience improved their perceptions of communication technologies	Participants explained how being forced to work and teach in a distant format improved their perceptions of communication technologies for multiple reasons, the most popular being: (a) providing needed experience and practice to build confidence, (b) general ease, convenience, and flexibility, (c) inspiration and possibilities for new ways to teach regardless of format, (d) for providing options for continuity during emergencies / pandemics, and (e) increased acceptance and adoption.
Experience did not change their perceptions of communication technologies	Other participants reported how their experience working and teaching from home during COVID did not change their perceptions either because they were already regular users of various communication technologies when they teach or because they still believe face-to-face / in-person communication cannot be replicated and/or because they believe learning at a distance is never as good as learning in person.
Experience increased concerns with communication technologies	Some participants reported how their experience working and teaching from home during COVID led to increased concerns about issues of inequity, access, and support or their general dislike for teaching at distance.

Phase Two: Interview Results

We conducted semi-structured interviews with 18 participants. The interviews were meant to elaborate on the survey questions and to provide additional insight into faculty perceptions of synchronous video-based communication technology. In many ways, the interviews simply supported the results and the themes that emerged from the survey. Below, we highlight the main themes that emerged from the interviews.

Changes in Use of Synchronous Video-based Communication Technology During COVID-19

Participants' use of synchronous video-based communication technology prior to COVID-19 varied greatly. While many described using it occasionally in their personal life (e.g., video chat with friends) or for work (e.g., collaborating with

colleagues in another country), some described using it rarely or never. But all participants described how their use of it had increased during COVID-19, whether to talk to family, take part in meetings, hold office hours, or teach a course. Even veteran online teachers talked about adding additional synchronous meetings because as one described it, “students really like the opportunity [to connect] ...we still have this human desire to speak [to each other].” Others also expressed their excitement about the increased use of synchronous meetings at work. One participant explained how “it’s no longer something that I am having to encourage my fellow faculty to be able to use.”

Strengths and Weaknesses of Synchronous Video-based Communication

Participants all recognized and had experienced some strengths and weaknesses with synchronous video-based communication (many that were discussed earlier in this article). In terms of strengths, participants pointed to flexibility/convenience/accessibility. They also mentioned that it can improve interaction and promote community building (including getting to know each other’s pets, for instance). Participants also indicated other benefits, such as being able to provide a “face-to-face” experience in real-time, facilitate meetings with varying group sizes, and improve group work/collaboration across the university or even the world. They also noted that these online meetings can usually be recorded for future reference or for those who could not attend, and that they can enable people to continue working even during a disaster or a pandemic. Some quotes stood out:

Gives us the ability to have the face-to-face real time communication that closely approximates the way that we would normally have conversations.

Helpful for people to learn names and a new organization because I’ve noticed, even from my now virtual book club, seeing everyone’s names on the screen has been a helpful visual cue.

There is a humanization that happens that you can’t get when you’re not talking directly to somebody or speaking directly to somebody. It doesn’t happen as well, or as much with asynchronous interaction. So, you get that real time interaction, you get the humanization.

However, participants were quick to identify some weaknesses of this type of communication. These included technical issues, dead silences/awkward pauses, access issues (broadband/technology), lack of body language as well as tendencies to keep webcams off, distraction, privacy issues, time zone constraints, lack of experience and familiarity with the tool, fatigue, and an intrusion on work life balance (which was exacerbated with entire families working from home together). The following remarks capture some of these ideas:

You just lose attention...

The kids talk less, they interact a lot less, so it requires a teacher to be so much more energetic and manipulative of technology...

I keep looking at my own video feed instead of staring at that camera which doesn’t look like an eye to me, you know, and I think that can make it hard to pick up on social cues.

Most...use their mobile phone and the quality is totally different. While they’re on the phones, they normally don’t turn on their cameras. So, it’s totally different in terms of how they learn and...the conversation.

Experiences With and Strategies to Combat “Zoom Fatigue”

A relatively new, yet widely experienced, side effect of taking part in synchronous meetings is what is now often referred to as “Zoom fatigue” or experiencing a “Zoom hangover”—that is, the feeling of being exhausted after a long synchronous meeting or back-to-back shorter synchronous meetings. When fatigue came up as a weakness of synchronous videobased communication, we asked participants about their experiences with it and how they addressed it. Most participants acknowledged that they had, in fact, experienced Zoom fatigue. However, there was little consensus about the length of time required to experience this fatigue; it took just 1 hour for some to experience it and up to 11 hours for another. At the same time, a few participants had never experienced it. Participants noted that

they proactively blocked off time before and after scheduled meetings, incorporated breaks or “stretch time” in longer prescheduled meetings, added interactivity (e.g., practice XYZ off-screen and come back to the meeting), observed a meeting moratorium day to recharge, extended the workday to accommodate breaks, turned off webcams, and prioritized some meetings over others. The following quotes capture some these sentiments:

Some people were very proud that they brought down their lecture from two hours to one hour, but for Zoom that's still quite a long time to be sitting and staring at a screen.

I think turning off that camera is helpful, because in some ways it functions in the same way...like in some meetings to people be like it's totally okay if you get up and walk around...it feels like being able to turn the camera off is a way of alleviating that zoom fatigue in some ways.

Here are, I think, some other ways that some of these providers are...helping you not to see your face as much because that we know that self-monitoring your own facial expressions can be really distracting.

Synchronous Video-based Communication Technology Influencing Future Work

Finally, we asked participants to reflect on how their experience using synchronous communication technology will influence how they do their job in the future. Nobody saw this technology drastically changing their job overnight. However, many did talk about how they expected more freedom and flexibility and research collaborations moving forward but also more synchronous meetings with colleagues and students. Others, though, also talked about how their experiences (and others) will likely help all of us use it more responsibly, in part by balancing our use of it but also by being aware of different aspects of netiquette as well as access. The following are quotations from various respondents on this topic.

I have a feeling we're going to have a lot more zoom based meetings in the future. I think it's going to give people more freedom and flexibility when it comes to meetings because we've seen that we can still do our work.

I'm expecting that the overall experience with zoom, not just mine, but in general. Will leave more flexibility for people to actually use it when it's appropriate... to really balance.

Our students lives even after the pandemic's over...will not be any less hectic than it was before.... So, this will be a convenient way to do office hours and hopefully connect with some more students that might be intimidated to come into one's office or just the office hours are not convenient for them.

I've discovered that I need to have more conversations like this with my students, I need to make the opportunity available.

Discussion

We began this study during the summer of 2020. At that point, while we were unsure what the future might bring, many signs suggested that the 2020-2021 academic year was going to be far from normal. As researchers of learning design and technology, we were interested in, and perhaps even a little nervous about, the sudden increased use of blended, remote, and online learning. There was a lot of initial press highlighting issues with using synchronous video-based communication (e.g., Lederman, 2020b; Setera, 2020; Strauss, 2020). Also, as mentioned earlier, many faculty members entered the pandemic with skeptical, if not completely critical, feelings about online learning. Given all of this, we were curious how faculty experiences working and teaching in these new formats might change not only how they teach but how they do other parts of their job moving forward.

The first research question focused on faculty perceptions of using synchronous videobased communication for personal use, teaching and learning, and for non-teaching work purposes. The data from this study were in some ways mixed. When specifically asked, participants reported being highly satisfied with synchronous video-based technology

in their personal and work life and especially for work not focused on teaching (e.g., committee work, advising, research). This differed from many popular media stories that painted a much grimmer picture as well as previous research which suggested mixed or negative perceptions of using synchronous video-based communication technology (see Liu & Alexander, 2017; Martin et al., 2020; Park & Bonk, 2007).

However, when asked to explain their answers, the only consistent positive theme was that they liked the convenience and flexibility of synchronous video-based technology to connect with family, friends, students, and colleagues during the pandemic. On the other hand, they pointed out several problems they found with synchronous meetings, including overuse and fatigue, lack of engagement and distraction, a learning curve for many, technical issues, and overall misuse of the technology which align with previous research (Liu & Alexander, 2017; Olson & McCracken, 2015). Online educators also need to be aware that research suggests that challenges like these can be more common for students of color and lower-income students (Means & Neisler, 2021).

The second research question focused on how faculty perceptions of communication technologies changed as during the COVID-19 pandemic. Most participants reported being the most satisfied with using email ($M=4.05$), which is a little surprising given how often faculty members, in our experience, like to complain about email. Research has confirmed that email comprises a sizable portion of online teachers' workload and the perceived need to respond quickly to email can leave educators feeling "that there is no 'down' time for online teaching" (Payne McLain, p. 54, 2005). Students, however, reported that emails positively impacted their learning and motivation, even more so than other forms of communication, such recorded video messages (Conklin & Garrett Dikkers, 2021).

After email, participants reported being more satisfied with synchronous meetings ($M=3.95$) than they were with asynchronous text-based discussions ($M=3.78$), thus, suggesting that faculty preference is not simply due to the asynchronous or synchronous nature of a communication technology but likely more how each is commonly used by faculty members. Most participants also reported that they were more likely to use synchronous video-based communication for work not related to teaching ($M=4.19$) and for teaching a blended or online course ($M=4.06$) than they were before the pandemic, thus suggesting that faculty perceptions of using synchronous sessions are improving.

Many described how being introduced to new communication technologies and/or gaining more experience during COVID-19 helped improve their confidence and comfort using communication technologies. Some even described how it inspired them to explore new ways of teaching and learning. Many, though, also pointed out that faculty members and students still have a lot to learn about how to effectively use this technology and therefore need additional training and support moving forward, which aligns with previous research like Olson and McCracken (2015). Future research and professional development should explore how online teachers can effectively blend synchronous and asynchronous learning activities (Olson & McCracken, 2015). For instance, Olson and McCracken (2015) found that simply adding synchronous sessions to an asynchronous course is unlikely to improve learning outcomes; instructors need support on how to strategically blend synchronous and asynchronous learning activities. When providing faculty members with professional development opportunities it is important to consider not only the topics but also how the professional development will be facilitated. Professional development is more effective when facilitators are modeling what is being taught so that participants can experience the strategies as a student (Borup & Evmenova, 2019). Universities—especially colleges of education—should also work to prepare their teacher education and doctoral students to teach online (Bishop-Monroe et al., 2021).

Limitations

The results from this study should not be generalized to all faculty. The majority of participants in this study taught in the field of education. The participants also self-selected to participate in this study, which could suggest that they either had very positive or negative experiences with synchronous video-based communication technology and/or teaching blended or online courses. The data for this study were collected early in the pandemic. Faculty perceptions could have changed, and still might change over time. Further, our findings are limited by the questions asked as well as limitations due to the qualitative data being analyzed by only one researcher.

Conclusion

The first online course was offered over 30 years ago (Harasim, 1987). However, despite the decades that have passed and advances in technology since, instructors and students largely interact in online courses in the same ways today as they did then, with asynchronous text-based communication. There is a good reason for this; asynchronous text-based communication has effectively enabled millions of students to learn online. The COVID-19 pandemic forced nearly every faculty member to work and teach from a distance and specifically to use a variety of communication technologies, including synchronous meetings, in ways they might not have before. We questioned how these new experiences might change faculty perceptions and, in turn, change online learning.

Our results suggest that faculty will use synchronous meetings more at work, both for teaching and nonteaching duties. Faculty members also will likely continue to explore additional ways to use synchronous meetings in their face-to-face, blended, and fully online courses, thus further blurring the lines between traditional face-to-face and online learning. However, additional research is needed to find out whether faculty in other disciplines as well as students share these same perspectives and desire for change. Consistent with our findings, the recently published Chloe Report suggests that synchronous video-based communication technology is gaining ground and is here to stay. Therefore, it is incumbent upon learning technologists like us to help guide, support, and study faculty members' use of it.

Declarations

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Appendix A

Survey and Instrument Questions

Phase One Survey Questions

Demographic Questions

How many years have you taught in higher education?

How many years have you taught blended or online courses in higher education?

Prior to the COVID-19 pandemic, how satisfied were you with teaching blended or online courses in higher education?

Prior to the COVID-19 pandemic, how frequently did you with using live synchronous videobased communication:

[Daily -- Never]

-Personal life

-Teaching traditional face-to-face courses

-Teaching and learning blended and online courses

-Work not related to teaching and learning (e.g., research collaboration, advising, committee work)

Survey Questions

1. Currently, how satisfied are you with using synchronous video-based communication (e.g., Zoom, WebEx) in your personal life (e.g., talking with friends or family)?

[(1) Very Dissatisfied --- Very Satisfied (5)]

2. Currently, how satisfied are you with using synchronous video-based communication (e.g., Zoom, WebEx) for teaching and learning?

[(1) Very Dissatisfied --- Very Satisfied (5)]

3. Currently, how satisfied are you with using synchronous video-based communication (e.g., Zoom, WebEx) for work not related to teaching and learning (e.g., research collaboration, advising, committee work)?

[(1) Very Dissatisfied --- Very Satisfied (5)]

4. Please briefly explain why you answered these three previous questions the way that you did.

5. Currently, how satisfied are you with using the following communication methods when teaching blended or online courses?

[Don't currently used - Extremely dissatisfied --- Extremely satisfied]

--Email -

-Phone call

--Text message (to one person)

--Group text or message (e.g., Slack)

--Asynchronous text-based discussions (e.g., Learning Management System like Blackboard or Canvas)

--Asynchronous video-based discussions (e.g., Flipgrid, VoiceThread)

--Synchronous video-based discussions (e.g., Zoom, WebEx)

6. To what degree do you agree with the following, once the COVID-19 pandemic ends:

[(1) Strongly Disagree --- Strongly Agree (5)]

--If is up to me, I am more likely to use synchronous video-based communication (e.g., Zoom, WebEx) for meetings at work?

--If it is up to me, I am more likely to use synchronous video-based communication (e.g., Zoom, WebEx) when teaching a fully online course?

--if it is up to you, I am more likely to use synchronous video-based communication (e.g., Zoom, WebEx) for teaching a traditional face-to-face course?

7. Please briefly explain why you answered these three previous questions the way that you did.

8. How has your experience working and teaching from home during the COVID-19 pandemic influenced or changed your perceptions of using communication and learning technologies in general for teaching at a distance (e.g., emergency remote learning, distance learning, online learning)?

Additional Comments

Phase Two Interview Questions

1. What are the strengths and weaknesses of using this type of communication technology?

2. Describe how you used synchronous communication technology (e.g., Zoom) prior to the COVID-19 pandemic and has your use changed during the COVID-19 pandemic?

3. Have you ever experienced "Zoom fatigue" or something similar? How have you adjusted your work/teaching to address this?

Do you expect your experience using synchronous communication technology (e.g., Zoom) will influence how you do your job, whether teaching or non-teaching, in the future?

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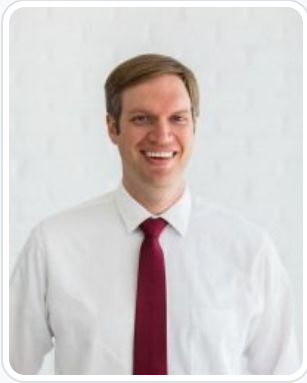
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The Handoff: Transitioning from Synchronous to Asynchronous Teaching

Richard E. West

Synchronous

Asynchronous Video

Online Teaching

Teaching and Learning

Variety in teaching modes can benefit students, and paying attention to the transitions is as important as choosing the best mode for learning activities.

The United States had been in quite a drought. The American 4×100-meter relay teams have consistently been among the fastest in the world—the men have won the gold medal at the Olympics fifteen times, while second place on the list is shared by the Soviet Union, Great Britain, and Jamaica, all tied at two gold medals. Meanwhile, on the women's side, the United States has won eleven gold medals, with East Germany next on the list with two. In addition, the United States men's team has medaled at all but seven Olympics.

But for twelve years, the United States had, astonishingly, been denied victory at the world stage. That changed on October 5, 2019, when the U.S. men's team finally ended the drought and claimed the gold at the world championships in Doha, Qatar.

But even then, it almost did not happen. In their qualifying heat, the United States botched two handoffs, the second of which was so poor that the team was very nearly disqualified. Anchor leg Noah Lyles had to push to keep the United States qualified for the final.

"I don't know...the timing was off. I hope we got in," Mike Rodgers told NBC Sports as the team anxiously awaited review to see if their final handoff was completed before the end of the handoff zone.



Play (k)
#NBCSports #ChristianColeman #JustinGatlin

Botched handoff leaves USA 4x100 team's fate in limbo | NBC Sports

[Botched Handoff Leaves USA 4x100 Team's Fate in Limbo](#)

The U.S. men's team was strong. They were prepared. But a poor transition from one part of the race to another nearly destroyed their momentum. Similarly, in teaching, teachers and students generate a momentum that propels the class effectively forward in learning. A change in modalities, however, can disrupt this momentum, causing students to disengage from the course or slowing the rate of learning as information is lost from one part of the course to another. This is particularly a concern in online learning where all of the communication happens via technology.

However, teaching all of the course in a single modality—for example, either completely through text-based discussion, videoconferencing, or asynchronous video—is also problematic. Variety can help students stay engaged, but moving from one part of the course to another carries a risk of poor handoffs. How can instructors effectively combine these different technologies and modalities in their teaching?

Know the Strengths of Each Modality

The first key strategy for teaching with multiple media is to understand the strengths and weaknesses of each. For example, with its increased fidelity or detail provided, video can be better at establishing connection, whereas text can be better for well-argued responses to questions. Synchronous technologies (such as live conversations or videoconferences) can be better for improvisational conversations, brainstorming, and quickly coming to agreement on a topic. Asynchronous technologies, such as discussion boards or asynchronous video, can be better for measured responses and increased flexibility for class members who are not located in the same physical space. Good instruction is more than just understanding the content of a course—it involves understanding how to best communicate that content to others, and the best option can vary depending on the subject, class objective, and the students involved.

Transition the Discussion from One Modality to Another

In my living room, there is a very small gap between the carpet and the laminate flooring. This gap is only one centimeter wide, and yet the exposed pins have caused enormous irritation to us walking barefoot in our home! The lesson? How we transition from one space to another matters a great deal in how well we enjoy those spaces. The same is true online, as care should be provided in how the course transitions from one online space to another. Here are a few suggestions to take advantage of the ebb and flow between online spaces with minimal disruption:

- **Spend the time to design your course well in your learning management system (LMS).** Try to provide all the links to all of the online discussion spaces within one place so students are not scrambling to find where they should go.
- **Have a clear purpose for each discussion or interaction.** Open-ended discussions in which students can "ask me anything they like" or "reflect on anything they find interesting in the reading" are useful sometimes, but often they become unfocused and feel like a waste of time for students. Thus, these discussions are often best offered as optional activities, office hours, or study sessions. More effective for required interactions are specific prompts such as "Jones and Smith mentioned X. How have you seen evidence for X in your own life?" or "How does their explanation of X further explain what we read last week about Y?"
- **Clearly communicate the purpose.** Because you are designing each interaction with a clear purpose, it is often helpful to tell students what that purpose is. If they understand why the asynchronous video or text discussions are important, for example, they may be more likely to stay engaged.
- **Be clear with students about which learning spaces begin a conversation and which ones end it.** For example, in one of my classes, we begin the week with a synchronous videoconference in which I introduce the coming topics for the week and frame the discussion. The class discussion then continues asynchronously through text discussions using online social annotation tools as the students complete the readings. We then end the week with an asynchronous video discussion in which students respond to reflection questions that draw upon all of the week's learnings. Then, the following week, we begin our synchronous video conversation by recapping the discussion from the previous week, answering any questions that were never resolved asynchronously, and highlighting the key points of the discussion. This provides some closure to the discussion from the previous week and helps students know that questions they raise asynchronously will be addressed, either in the text discussions, the asynchronous video discussion, or the videoconference.
- **A chronological view within an LMS is often helpful for students,** enabling them to move step by step through the assignments for the week and know which activities begin or continue which discussions (see figure 1).
- **Alert students to what work should be completed before, during, or after a class discussion.** For example, you might ask students to complete the readings before participating in the asynchronous video discussion; or you could ask them to bring unfinished work to a synchronous session so they can raise concerns with the group. You might ask during a videoconference for students to record asynchronous responses to the day's discussion, or you might ask them in discussion boards to brainstorm ideas that will be discussed later through video. By reflecting on what you want students to do before, during, and after their interactions with you, you are also reflecting on what you see as the purpose for every activity, which will help you prepare better learning activities.
- **Having a consistent rhythm for the class is usually helpful for students.** For example, students appreciate having synchronous sessions at the same time each week and having the same window of time for responses to asynchronous discussions.
- **Establish expectations for interactions between students.** Asynchronous discussions can feel like "shouting into the wind" if people do not return to read or "hear" the comment and respond. Thus, an important approach is to develop class norms about when people will provide the first post and when (and how often) they will return to participate in responses.

Lesson 2: Research, Knowledge, Theory & Paradigms [~2.25 h...
Complete All Iter

Lesson 2 Overview [10 min]
May 2 | Mark done

Lesson 2 Reading

Group Annotation - Riddle [30 min]
May 2 | 1 pts | Mark done

Group Annotation - Kimmons A [35 min]
May 2 | 1 pts | Mark done

Read On Your Own - Kimmons B [15 min]
May 2 | Mark done

Asynchronous Discussion 1 [30 min]
May 2 | 0 pts | Mark done

Looking Ahead (Lesson 2) [5 min]
May 2 | Mark done

Figure 1. Sample lesson from a graduate course, indicating the order of discussions

Use Higher-Fidelity Technologies Earlier to Establish Social Presence

Some of the ways we communicate are richer and deeper than other modes of communication in how they engage us. For example, do you yourself more easily distracted in an in-person conversation or in a videoconference? What about in an email correspondence?

The more that all of our senses are engaged in the process of understanding and perceiving others, the more potential there is for our engagement, which also increases the likelihood of feeling a sense of connection, understanding, and

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trust with each other.

In discussing various ways we can facilitate online or blended learning, Charles Graham referred to these spaces as having four dimensions: space, time, fidelity, and humanness (see figure 2). A "traditional" in-person class, for example, is limited in both space and time—the class meets at the same time and at the same place each week. However, it has high fidelity, as we can see, hear, touch, and even smell each other. This makes us seem more "human" to each other, and we feel a greater ability to relate to each other as people rather than as names or avatars.

Dimensions of Interaction

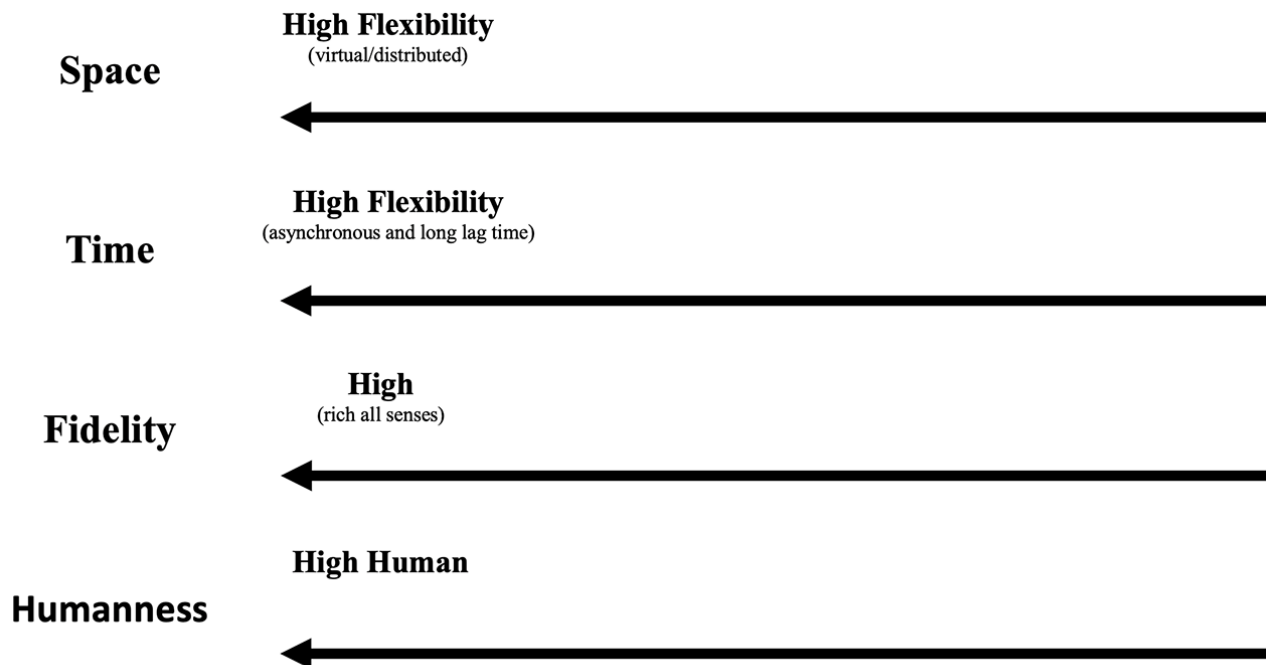


Figure 2. Graham's dimensions of online learning spaces

In general, in-person teaching has more fidelity than online teaching and video has more fidelity than text. This is, of course, a general statement with plenty of exceptions—for example, an immersive experience watching a movie in a theater can have higher fidelity than watching an elementary school play from the back of a gym where you cannot hear or see very well. The point is that some learning experiences have higher fidelity than others, and higher fidelity is usually helpful in establishing relationships and norms. For this reason, often the best strategy is to schedule these higher-fidelity experiences at the beginning of the course. For example, many online programs require students to attend an in-person retreat at the beginning of their studies. Similarly, many effective teachers begin their courses with in-person class sessions before moving online—or at least begin with synchronous video sessions before moving to asynchronous discussions. Holding higher-fidelity sessions at the end of the course can also help bring closure to the human experience the students and instructor had together in the course.

Use More Efficient Technologies Later to Complete Projects



Depending on the task, higher-fidelity media tend to be comparatively inefficient. How many meetings have you sat through and thought "This could have been an (asynchronous) email"? Perhaps the takeaway is this: When the goal of the activity is to efficiently complete straightforward tasks or communicate information that is easily understood, select a medium that emphasizes flexibility and focuses the communication to a point. When the goal is to develop relationships, increase connection and engagement, or brainstorm and problem solve, select a medium with greater fidelity.

Be Aware of and Sensitive to Students' Needs

This article ends with a big "but," which is, above all, we need to understand and know our students' needs. Less flexible learning environments may have higher fidelity, but pay attention to whether the lack of flexibility excludes some learners from participating. If it does, we may be perpetuating and extending systemic prejudices that prevent some groups of students from succeeding to the same degree as others. For example, even though in-person meetings can build relationships, they can exclude the mother with young children at home, the working professional unable to leave work, or the international student working in the middle of the night to participate. Synchronous videoconferences can provide the back and forth of conversation unless some participants have poor internet access or no access at all.

In addition, even in perfectly equitable learning conditions, there is great variety in how students engage with various media. Introverted students often prefer asynchronous settings in which they can compose their thoughts before posting. However, extroverts may find this tedious and prefer synchronous settings where they can "think out loud." International students often can read a non-native language better than hear it and, as a result, can better participate in text-based discussions. Sometimes, the difference comes down to just a simple learning preference. For example, I like to listen to conversations while standing or doing something routine like housework because it helps me focus.

Know Your Students, Know Your Technology

All of this means that the best answer needs to be personalized to your teaching situation. Within that truth lie a few key conclusions:

1. Instructors should seek to understand the strengths and weaknesses of various communication technologies and thoughtfully consider which to be most effective for each learning activity.
2. Instructors should pay attention to the transitions from one modality to another so that students understand where they are supposed to go for a discussion and why.
3. Variety can be helpful, as it can enable students with different learning preferences to participate in the ways they find most comfortable.
4. Be aware of students' needs and provide alternative ways for students to participate in a conversation if needed.

Oftentimes compromises must be made between flexibility, equity, and fidelity. Recently, asynchronous video has emerged as one technology that may hold great promise as an educational method that can be both flexible and higher in fidelity than text-based discussions. It may not be the right answer for every teaching scenario, but it could be another arrow in the quiver for instructors.

Acknowledgment

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Notes

1. See [4×100 metres relay at the Olympics](#), Wikipedia.
2. ["U.S. Men End 4×100m Relay Drought with First Title in 12 Years."](#) NBC Sports, October 5, 2019.
3. Charles R. Graham, ["Blended Learning Systems: Definition, Current Trends, and Future Directions,"](#) in *The Handbook of Blended Learning: Global Perspectives, Local Designs*, eds. Curtis J. Bonk and Charles R. Graham (San Francisco: Pfeiffer Publishing, 2006), 3–21.

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Improving Problem-Based Learning with Asynchronous Video

Richard E. West

Video

Education

Higher Education

Learning

Asynchronous Video

A thoughtful approach to incorporating video can allow problem-based learning to flourish in online settings.

In 2015, Deloitte surveyed nearly 8,000 millennials about the skills needed for work. One of the conclusions of this investigation was that higher education did not prepare these millennials with many of the skills they needed for their actual careers as much as learning on the job did.

Collectively, higher education said, "Ouch."

This does not mean higher education is not important in preparing students for their careers, but it does suggest that we need to reconsider our strategies. Some evidence suggests that problem-, inquiry-, or project-based teaching methods can more effectively prepare students for the kinds of problems and projects they will face in their careers. In short, we can better prepare students to bridge the skills gap.

What is problem-based learning? It can refer to a very specific method developed by Howard Barrows. However, I will use the term more broadly to refer to a collection of strategies that focus on providing students with authentic, real-life problems related to their discipline. Students are presented an authentic problem and given support as they work together to solve it. In doing so, they get to practice in school the kinds of decision-making they will do in their careers—but in a safe environment where failure is less consequential. This can help them develop both content knowledge and critical thinking skills.

Here is the challenge, though: how can you support problem-based teaching strategies when you are teaching online? When courses move online, quite frequently they regress toward teacher-centered strategies in which the instructor records a lecture, students read a textbook or online articles, and then the class discusses their thoughts in a discussion board or through video discussions. Although this is not necessarily ineffective teaching, it is incomplete

without additional problem-centered activities. But how can instructors support, guide, and develop collaboration and problem-based thinking strategies online?

One possible strategy to help support effective problem-based learning (PBL) is to use asynchronous video—video communication that is recorded when the participants want to record the video instead of all at the same time, as happens in videoconferencing. Similar to videoconferencing, asynchronous video can help develop relationships of trust and connection among the members of a problem-solving team. This sense of connection is critical to collaboration, and particularly key to team creativity, because connection is a prerequisite to developing trust within a team, where each team member feels psychologically safe sharing their ideas. This psychological safety is one of four key facets that Neil Anderson and Michael West found contributed to a positive team climate for innovation, along with a shared group vision, a commitment to excellence by each team member, and support for innovation in the organization. Because asynchronous video can communicate nonverbal cues, we have found in our research that it can deepen this sense of connection and community.

Besides deepening a sense of connection, asynchronous video can support problem-based learning in two other ways: first, by communicating more information about the problem context, and second, by facilitating effective team communication.

Asynchronous Videos as Triggers for Problem-Based Learning

Good problem-based instruction begins with a good trigger, or an authentic problem, described in its context. Often these triggers are written case studies, but providing visual context is important too. Before asynchronous video was common, instructors often provided images as part of problem-based learning triggers. More recently, though, researchers have studied how video can benefit PBL and discovered that video triggers can be more motivating, are preferred by many students, and can help them develop more realistic understandings of the problem.

As an example, one team of scholars at the University of Hong Kong studied the PBL sessions of students who received text triggers versus those who received video triggers. They found that those who were prompted by video spent less time simply defining and identifying the problem and more time exploring the solution—and students developed better observational and reasoning skills. In other words, they understood the problem quicker and were able to more efficiently move toward solving the problem. As these scholars explained about the use of video as a trigger in medical education, "Video may be a better medium because it preserves the original language, encourages the active extraction of information, avoids depersonalization of patients, and allows direct observation of clinical consultations. In short, it exposes the students to the complexity of actual clinical problems."

Using Asynchronous Video to Support Team Interactions



Image CC-BY/SA from www.lumaxart.com/

Aside from serving as a trigger to start students on their problem-solving activity, asynchronous video can also be helpful in managing group interactions. A well-known problem with group creativity is the danger of falling into groupthink, in which the group coalesces too quickly around an idea without individual thinking, analysis, and questioning. This can be particularly problematic in synchronous situations, such as in-person discussions or live video conferences, because after one person in the group offers a suggestion, it becomes difficult, cognitively, for students to *not* think about that suggestion and instead consider new ideas. To combat this problem, team leaders will often ask members of the team to first identify their own ideas and rank them, prior to meeting together where the team can discuss the ideas and reach consensus.



When team members are asked to develop their own ideas independently, the team is less likely to fall into groupthink. Because of the danger of groupthink, using asynchronous video can be an effective strategy for initial group brainstorming discussions by asking team members to first submit video responses showing their ideas for solving the problem before then viewing their peers' videos. In addition, because asynchronous video slows down the conversation, participants may be more thoughtful in their responses, especially if they can delete their response and resubmit a revised idea.

Using video in problem-solving teams has also been shown to help overcome cultural barriers—asynchronous video carries the added benefit of allowing team members who speak other languages to replay or slow down the video to improve comprehension. Many tools also allow for qualitative analysis of asynchronous video to sort portions of video into different themes/topics, which can help leaders or team members better evaluate and improve team processes. Also, in some situations, it may be helpful to have students create videos as the outputs of their problem-solving exercise in order not only to better communicate their PBL outputs but also to be able to explain their problem-solving processes and thinking.

Finally, an important member of any problem-solving team is the instructor, who can provide advice, mentoring, context, and other forms of assistance. Because problem-solving teams within the same class may be working on different timelines, different problems, or at different paces, asynchronous video can be helpful for allowing these student teams to ask the instructor for assistance when they need it. The nature of video may also allow the instructor to more quickly engage in the brainstorming process with students than through text.

Asynchronous Video: A New Frontier in Problem-Based Learning

As new technologies have emerged in the past few years, asynchronous video is becoming easier to use in more and varied ways. This is a new frontier, and much research is still needed to understand its potential effects. For example, while some research has found that video can deepen critical thinking and comprehension for students, other studies have argued the opposite, perhaps because the video contains distracting elements. Also, while students in some studies said they like the use of asynchronous video, students in other studies prefer text communication or triggers.

This variability is not surprising. The research in this area is still very new, and students often have differing preferences for how and when they prefer to engage in education. What is important, though, is for teachers to use a variety of methods for engaging their students and to explore when, where, and why these different methods can support the students they teach. For this reason, asynchronous video is an intriguing addition to the standard approaches already used to support problem-, project-, and inquiry-based learning.

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Let's Discuss Discussions

Using Asynchronous Video to Improve Online Discussions

Jered Borup

Online Learning

Learning

Online Courses

Asynchronous Video

Student discussions are an important part of learning. Discussions allow students to be active participants in constructing knowledge and meaning of the material. In-person discussions can be energizing, with rapid exchanges where students can express both their knowledge of and feelings about a subject. These discussions can be memorable experiences that not only help students learn but also change how they relate to the course material. For instructors, it can be exciting to see students engage in meaningful discussions. However, instructors sometimes overestimate students' engagement in discussions, and whole-class discussions are often dominated by only a handful of students. In-person class discussions favor extroverts and frequently lack the voices of introverts, language learners, and others who require flexibility to reflect and form responses.

In contrast to in-person discussions, asynchronous online discussions allow for more equitable opportunities to participate. The flexibility inherent in online discussions also allows participants to be more reflective in their comments. However, most of these discussions occur using text. Text is helpful for critical thinking but can lack the communication cues that allow participants to connect with the material and other students. As a result, students can feel uninterested and isolated.

Discussions Using Asynchronous Video

In many ways asynchronous video communication can combine the best of in-person and text discussions. Similar to text-based communication, video messages are recorded and allow for high levels of flexibility and participation. Once video messages are shared, students can watch and/or respond to them immediately or when it is convenient. At the same time, they contain the fidelity and communication cues that help make in-person communication powerful.

Instructors should be aware, though, of video messaging's disadvantages. First, recording and posting messages can be uncomfortable for students initially. That said, in our research, students reported that the discomfort they felt tended to decrease significantly after just a few posts.^{Footnote1} Second, video messaging can be less convenient than text because you need to find a relatively quiet place to record videos and because skimming video is more difficult than skimming text. However, participants in our research tended to find that the benefits outweighed the potential drawbacks in most cases.

Using Asynchronous Video When It's the Best Option

Not all online interactions should take place using asynchronous video. The questions below will help you to determine when to use video and when to use text.

If you answer "yes" to any of these questions, then the use of asynchronous *video* would be beneficial:

1. In part, are you assessing students' ability to speak or present on the topic?
2. Are you hoping that this discussion will help establish a sense of community?
3. Is it important for you to know how students feel about the topic?
4. Do some students in your course have difficulty communicating in text?

If you answer "yes" to any of these questions, then the use of asynchronous *text* would be beneficial:

1. In part, are you assessing students' ability to write on the topic?
2. Are you primarily assessing students' critical thinking on the topic?
3. Is a written record necessary for future review?
4. Do some students in your course have difficulty communicating using video or viewing/hearing video?

It's likely that you responded "yes" to questions in both lists. When that's the case, you may want to create activities that combine text with video comments or provide students the choice of which modality they use to comment.

Types of Activities

In most cases, using a variety of discussion activities throughout a course is beneficial for students and instructors. Table 1 shows a partial list of asynchronous discussion activities.

Table 1. Asynchronous discussion activities

Activity Type	Description
Reflections and Replies	A common activity in online courses is for students to read and/or view material, reflect on it, and then share their thoughts and related experiences. It's also common for instructors to require students to reply to a certain number of their peers' comments.
Round-Robin Reflections	Similar to reflections and replies, in round-robin reflections, students still read and/or view material, reflect on it, and then share their thoughts and related experiences. In addition, students ask a related question that they would like to know the answer to. The next person to post to the group then answers the previous person's question, shares their thoughts and related experiences, and asks a question. This continues until everyone has posted. The instructor might then choose to have the first person who posted return to and respond to the last person's question.

Activity Type	Description
Debates	In many subject areas, debates are a common in-person classroom activity. With some preparation, these debates can also be done online with even more reflection and participation than is possible in person. Just as with in-person debates, the instructor should set the ground rules for communicating respectfully. The instructor can break down the online debate into the different phases and set deadlines for each phase. For instance, one day can be designated for opening statements. Other days could be designated for rebuttals. Lastly, students end the debate with closing statements on the last day.
Check-Ins and Updates	During longer projects or experiences such as practicums or internships, having students post regular updates helps instructors keep a pulse on students' progress. As a result, these updates hold students accountable for their activities even in the absence of a hard deadline. These check-ins also give students an opportunity to ask for assistance. Making these posts using video can help students maintain a sense of community.
Jigsaws	In a jigsaw activity, students are placed in a discussion group of about three to six students. Each student is tasked with learning a different aspect of the topic. As a result, in preparation for the discussion activity, each student is focusing on and exploring different materials. Each student then shares their learning with the rest of the group. This allows students to teach one another so that together everyone is able to form a full picture of the topic.
Peer Reviews	Instructors can use asynchronous video to provide feedback . Similarly, students can use video comments to provide their peers with feedback on projects. Students can share links to their project with a video comment describing their work. Students can then review the projects and provide feedback using either webcam or screencast recordings.

Focus on the Prompt

If a discussion you design for an in-person class flops, you can quickly adjust the activity on the fly. Although the same can be true for an online activity, making those changes mid-stream can be more difficult than in an in-person setting. As a result, instructors need to think more carefully about online discussion prompts. Although one can never be sure if a new discussion prompt will result in the desired learning outcomes, the guidelines below can help increase the likelihood of success. Many of these guidelines and the table 2 below are drawn from ["Generating and Facilitating Engaging and Effective Online Discussions"](#) (it's worth a read if you have time).

- **Prompts should be open-ended** and allow for multiple correct responses. Good discussion-board prompts also measure higher-order thinking skills. In many ways it's easier to write good discussion prompts that require divergent and evaluative thinking than it is to write good prompts that only require convergent thinking because you don't want the students to arrive at the same conclusion too quickly. See table 2 for examples.
- **Have students discuss in small groups** (four to eight students) rather than whole-class discussions.
- **Set clear expectations** on the length and number of posts that are required.
- **Provide incentives for participation.** Points should typically be given for participation. However, how those points are awarded can vary. At times you will want to use a rubric, which will allow you to assess the quality of comments. However, simply awarding points for participating is sufficient in some cases.

Table 2. Writing Good Discussion Questions ([University of Oregon Teaching Effectiveness Program](#), licensed under Creative Commons BY-NC-SA)

As you prepare questions for a discussion, think about what is most important that students know and understand about the topic (the article you asked them to read, the last lecture on the topic, the chapter in the book, etc.). Shape your questions with that goal in mind. Avoid questions that prompt a yes or no answer. If you get that kind of answer, ask the student to go further and justify their response. Ask them to refer to the reading they were to do for support for their statements, ideas and opinions.

Here are some question types that stimulate different kinds of thinking:

Convergent Thinking	Divergent Thinking	Evaluative Thinking
Usually begin with: <ul style="list-style-type: none"> • Why • How • In what ways... 	Usually begin with: <ul style="list-style-type: none"> • Imagine • Suppose • Predict... • If..., then... • How might... • Can you create... • What are some possible consequences... 	Usually begin with these words or phrases: <ul style="list-style-type: none"> • Defend • Judge • Justify... • What do you think about... • What is your opinion about...
Examples: <ul style="list-style-type: none"> • How does gravity differ from electrostatic attraction? • How was the invasion of Grenada a modern-day example of the Monroe Doctrine in action? • Why was Richard III considered an evil king? 	Examples: <ul style="list-style-type: none"> • Suppose that Caesar never returned to Rome from Gaul. Would the Empire have existed? • What predictions can you make regarding the voting process in Florida? • How might life in the year 2100 differ from today? 	Examples: <ul style="list-style-type: none"> • What do you think are the advantages of solar power over coal-fired electric plants? • Is it fair that Title IX requires colleges to fund sports for women as well as for men? • How do you feel about raising the driving age to 18? Why?

Facilitating the Discussions

Something of a Goldilocks principle is at play in how much the instructor should participate in an online discussion. An instructor who participates too much can actually shut down the discussion by making the activity instructor-centered and not student-centered. However, students also require the instructor's content and pedagogical expertise. Instructor comments can motivate students to increase the quantity and quality of their comments. As a result, if the instructor participates too little, then students may not gain much from the discussion.

Cranney et al. conducted an interesting study examining this phenomenon by correlating student grades on discussion-based activities with the instructor's participation in those discussions.^{Footnote2} Specifically, two figures from their study help tell the story. Figure 1 shows a strong correlation between the amount of time that instructors spent in the online course discussion and students' grades on the discussion. However, as shown in figure 2, only a weak correlation emerged between the number of instructor posts to the discussion and student grades on the discussion activity. This

indicates that it's important that instructors spend time monitoring student discussions, but they should focus more on the quality of their posts rather than on posting a lot of comments.

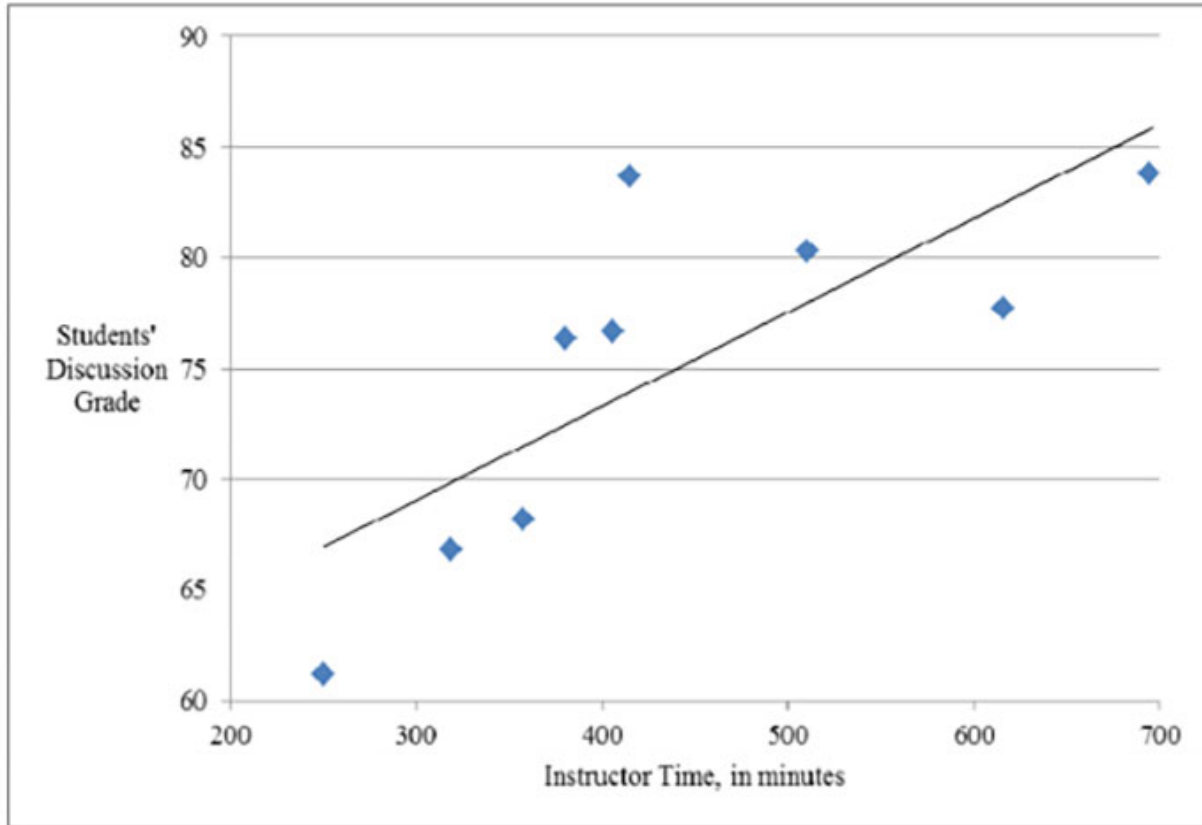


Figure 1. Amount of instructor time spent in online course in relation to students' overall discussion grade

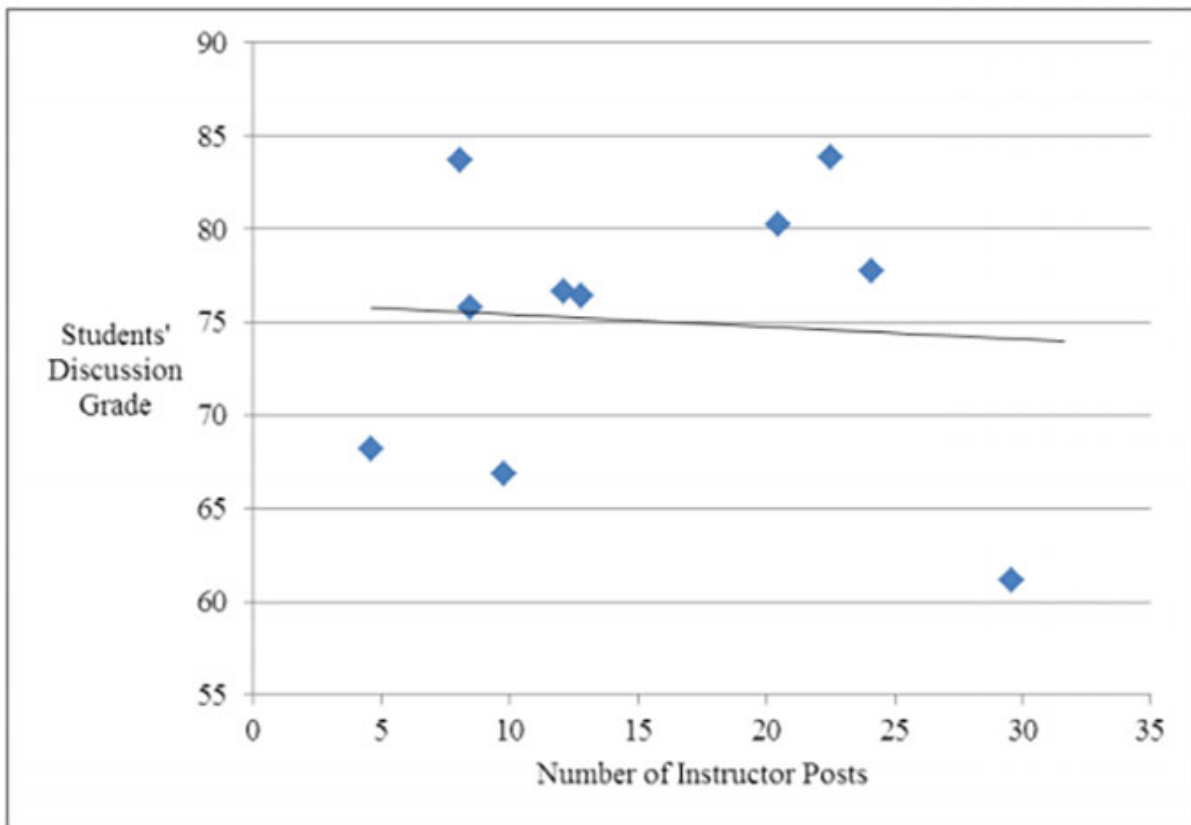


Figure 2. Number of instructor posts in the online discussion forum in relation to students' overall discussion grade

When instructors make comments they are actually fulfilling three important roles: policing, judging, and mentoring. This short video below explains each of these roles.

If you have just a few minutes, Cheryl Hayek has one of the [best and most memorable answers](#) to the question, "How many posts should the instructor make?"



[Watch on YouTube](#)

Managing Your Discussion Board

Conclusion

Discussions are critical in helping students construct understanding. Text-based discussions can help students reflect and think critically but can lack the human touch and emotion that add meaning and interest to what's being discussed. By engaging in discussions using video recordings, students can communicate more personally while still maintaining time to reflect between exchanges. However, asynchronous video discussions still require a quality prompt and instructor facilitation.

Acknowledgment

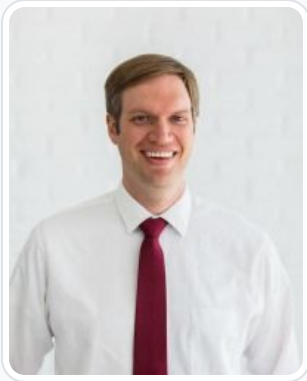
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Notes

1. Jered Borup, Richard E. West, and Charles R. Graham, "[Improving Online Social Presence through Asynchronous Video](#)," *The Internet and Higher Education* 15, no. 3 (2012).
2. Michelle Cranney, Lisa Wallace, Jeffrey L. Alexander, and Laura Alfano, "[Instructor's Discussion Forum Effort: Is It Worth It?](#)" *MERLOT Journal of Online Learning and Teaching* 7, no. 3 (September 2011).

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Motivations Among Special Education Students and their Parents for Switching to an Online School

Survey Responses and Emergent Themes

DeLaina Tonks, Royce Kimmons, & Stacie L. Mason

K-12

Virtual Classrooms

Special Education

school choice

Research focusing on the experiences of special education students in online K–12 schools is scant despite growing numbers of enrollments. This study utilized an emailed survey to understand the motivations and experiences of a group of special education students ($n = 30$) and their parents ($n = 29$) while enrolled in an online K–12 school in the U.S. Responses indicated that the three most compelling reasons for choosing the school were flexibility, previous poor fit, and teacher availability. Qualitative analysis of open-ended responses produced two major themes—prior experiences and affordances of the learning environment—with sub-themes related to bullying, personnel, academics, disabilities and accommodations, health considerations, lack of support, self-determination, and the where, when, and how of online learning. These findings may help policy makers enact policies and online educators adapt their approach to better meet the needs of K–12 students with special needs.

In the United States, special education is governed primarily by federal laws, which include several landmark cases positioned to ensure equitable access to education for all students. Special education became a recognized civil right for children with disabilities near the end of the 20th century when Congress enacted legislation known as the Education for All Handicapped Children Act on November 29, 1975. This legislation ensured that students with disabilities occupied a specified seat in secondary and post-secondary education in the United States and today is referred to as the Individuals with Disabilities Education Improvement Act (IDEIA) (20 U.S.C. § 1400, 2004). All public schools are now required to provide a free appropriate public education, a standard commonly referred to as FAPE, to all

of their students (20 U.S.C. § 1400, 2004). As such, public online schools are bound by the same laws and rules as their public brick-and-mortar district and charter school counterparts: to meet the needs of all students.

Online, or cyber, schooling has expanded rapidly over the past 20 years (Beck et al., 2014; Clifford, 2018). The 2020 Keeping Pace Snapshot estimated enrollments of 375,000 full-time and several million part-time online students in 2018-2019 (Digital Learning Collaborative, 2020). The number of students with special needs attending online schools has also increased (Beck et al., 2014; Molnar, 2019). Yet, little research has been done to understand the experiences of special education students in online schools (Barbour & Reeves, 2009; Burdette et al., 2013; Clifford, 2018). Studies on how to meet the needs of lower-performing students and students with disabilities have lagged to the point that researchers have issued various direct calls to determine the quality of their online learning experiences (Cavanaugh et al., 2009; Ferdig & Kennedy, 2013; Vasquez & Serianni, 2012). The current study is an answer to this call.

Review of Relevant Literature

The recent expansion of online schooling may be attributed to various benefits and to the changing dynamics of modern educational offerings (Barbour & Reeves, 2009; Cavanaugh, Gillan et al., 2004; Hassel et al., 2001). Students and parents have indicated that they chose online schools both to flee negative environments and to take advantage of online schools' flexibility and convenience (Ahn, 2011; Beck et al., 2014; Hasler-Waters et al., 2014; Macy et al., 2018). State directors of special education have likewise indicated that flexibility was a driving factor behind offering online education (Burdette et al., 2013).

As of the 2017-2018 school year, "the proportion of special education students in virtual schools with data was higher than the national average" (Molnar et al., 2019, p.8). This finding represents an increase in enrollments since the 2015 report, which stated that special education students were enrolled in online schools at lower rates than the national average (Molnar et al., 2015). In both reports, the statistics present only part of the story, as parents and school administrators apply designations inconsistently and some schools and states do not report data about students with disabilities (Beck et al., 2014; Betts et al., 2013; Clifford, 2018; Molnar et al., 2015; Molnar et al., 2019). Previous studies (Beck et al., 2014; Fernandez et al., 2016; Woodworth et al., 2015), our own personal experiences with K-12 online schools, and our interactions with colleagues in other states indicate that some online schools have enrolled students with disabilities at higher rates than state averages.

In some ways, online schools may be better suited than traditional schools to meet special needs (Basham et al., 2015; Beck et al., 2014). Students can learn at their own pace, reviewing material as needed. Teachers can tutor small groups or individuals, achieving Bloom's 2 sigma ideal (1984) of discovering group instructional methods that provide results as effective as one-on-one tutoring. When instructional content is both online and open, teachers can adapt learning materials to meet diverse needs, differentiate instruction, and align instruction with standards (de los Arcos et al., 2016; Geith & Vignare, 2008). These best practices are useful for students generally but may be especially helpful for students with disabilities.

However, for online schools to realize these benefits, teachers must be prepared to provide effective online instruction for their students with disabilities. Teaching online requires different competencies from traditional teaching (Ahn, 2011; Pulham & Graham, 2018), and few training programs prepare teachers to teach online (Basham et al., 2015). Though teacher training programs provide special education training, many states face shortages of qualified special education teachers (Mason-Williams et al., 2019; Peyton et al., 2020) and many general education teachers lack understanding of how to meet students' special needs, or their responsibility to do so (Cavendish et al., 2020; Kozleski, 2020; Rice & Carter, 2015).

Furthermore, instruction should be designed for accessibility, yet those designing online instruction may not understand principles of universal design (Betts et al., 2013; Macy et al., 2018; Singleton et al., 2019). Students with disabilities may face multiple barriers to accessibility, such as text complexity, visual components, and navigability (Clifford, 2018). In an analysis of websites for K-12 special education cooperatives serving students aged 3 to 21, Baule (2020) found that

only 25% of websites analyzed met basic levels of accessibility compliance, and a recent nationwide study of K-12 school websites found that most school websites fail accessibility checks with a very high number of basic errors, such as insufficient contrast between text and backgrounds, lack of alternative text on images, missing form labels, etc. (Kimmons & Smith, 2019).

Since they are physically separated from their teachers, online students with special needs require especially strong support at home (Carnahan & Fulton, 2013; Ortiz et al., 2017; Schuck & Lambert, 2020). Regardless of a student's ability, online schooling requires parents and family to invest significant time; parents of students of disabilities have reported spending one to seven hours per day helping their child with online school (Clifford, 2018). In some cases, parents may act as the primary instructor while the teacher takes the support role (Barbour, 2009; Carnahan & Fulton, 2013; Ortiz et al., 2017; Rice & Carter, 2015). While parents have the advantage of knowing their child better than the teacher does, and some parents may welcome the opportunity to be more involved in their children's schooling (Sorensen, 2019), most parents lack the training and resources to provide the support and instruction that online schooling may require. Despite these challenges, researchers have still found that parents of special education students preferred their children's online schools to previous brick-and-mortar schools (Beck et al., 2014; Clifford, 2018).

Teachers have likewise indicated that teaching online is challenging, due to large caseloads, a lack of known best practices, lack of parental support, and feelings of being disconnected from their students and from other teachers (Clifford, 2018; Hawkins et al., 2012; Rice & Carter, 2016; Schuck & Lambert, 2020). Online special education teachers have indicated that they see their role "as more 'facilitators of' than 'designers of' instruction" (Clifford, 2018, p. 39), because most virtual schools use pre-packaged curricula (Crouse et al., 2016; Greer et al., 2014; Rice & Carter, 2016). Online special education teachers have reported that they felt proficient in their teaching roles though they lacked formal training to teach students with disabilities online (Crouse et al., 2016).

Studies suggest that student achievement in online schools has been lower than in brick- and-mortar schools (Clifford, 2018). Barbour et al. (2017) found that online students performed at lower levels than their brick-and-mortar peers. Woodworth et al. (2015) similarly reported that online students showed less improvement in reading and math than students in brick-and-mortar schools. Fernandez et al. (2016) reported that among participants in the study, students with special health care needs (as identified through the Child with Special Health Care Needs Screener) had earned significantly lower grades in online schools than in brick-and-mortar schools. Molnar et al. (2019) reported that only 48% of reporting virtual schools had received acceptable ESSA (Every Student Succeeds Act) performance ratings in 2017-2018, and 56% of virtual schools had not received ratings.

Studies of student perceptions show mixed experiences with online schools (Clifford, 2018). In a study by Harvey et al. (2014), most virtual school students said they liked online classes and were satisfied with the amount of interaction with teachers but dissatisfied with social and extracurricular opportunities. Oliver et al. (2009) reported that in Likert-scale responses, most virtual school students expressed satisfaction with their teachers' knowledge, training, and instruction, but in open-ended responses, many students indicated that they felt disconnected from teachers and dissatisfied with instruction.

Little research has been done to understand the experiences of special education students in online schools (Barbour & Reeves, 2009; Burdette et al., 2013). In the few existing studies, students with special needs, like the larger student population, have reported mixed experiences with online schools (Clifford, 2018). Woodfine et al. (2008) reported that students with dyslexia in online synchronous classes reported feeling embarrassed and anxious, falling behind, avoiding tasks, and being excluded from activities due to their disability and accompanying low confidence. In contrast, Beck et al. (2014) found that special education students reported higher satisfaction with online school and lower satisfaction with prior schools than did their peers.

More research is needed to understand special education students' motivations for and experiences while attending online schools. To this end, we surveyed a group of special education students enrolled in a public, online school in the western U.S. and their parents, to better understand students' motivations for attending the school and their experiences while attending it. We used both descriptive statistics and qualitative methods to analyze responses.

Methods

The guiding questions of this study were: (a) Why did students with specific special education needs (and their parents) choose this online school? and (b) How or why is it working for them? We utilized a survey methodology with both Likert-scale type and open-ended questions to gather data from both groups for descriptive and qualitative analysis.

Context

The targeted online school opened in 2009 with 127 ninth graders and seven faculty and staff. Of those initially enrolled students, only 3.9% had special education classifications. Enrollment at the school steadily grew as new grades were added, and by the 2016-2017 school year, it had grown to 525 students between grades 8-12, 15.4% of whom had special education classifications. This is higher than the Utah state average for special education students, which has hovered between 11% and 13% since the school opened in 2009 (National Center for Education Statistics, 2017).

In previous school surveys, students indicated that they had enrolled because (1) their previous educational setting was not working for them, (2) they valued the flexibility of fitting school in around their own schedule, and (3) they enjoyed the interactions they had with their teachers (Swinton, 2017, p. 5). Content is available asynchronously and can be accessed from any device so students can work anywhere and anytime. The school also operates on a curricular model that emphasizes the use of open educational resources (OER) and hires teachers with instructional design skills to create, adapt, and remix these materials to meet student needs.

All coursework is organized into weekly folders and is due at 6:00 p.m. each Friday. General education teachers are available four hours a day during office hours, and by appointment, via chat, video conference, phone, or email to assist students as needed. During the other four school hours per day, teachers contact parents, grade student work, analyze data to inform instruction, and reach out specifically to struggling students to motivate them. In order to be responsive to parents and students, all administrators, faculty, and staff adhere to the school communication policy of responding to all communications within 24 hours (Employee Handbook and Policy Guide, 2017). In the event a teacher is not readily available to assist a student, a 24-hour tutoring service is also available. Students can access a certified educator or instructional paraeducator to tutor them in math, science, or English through a single button click. If a student is struggling significantly, they may be required to work with a certified tutor or instructional paraeducator.

Participants

Given the scope of our research question, we focused our study on returning families with full-time 8–12 grade special education students who had an existing IEP prior to attending the school, to ensure the parents and students have enough experience with this particular special education program to answer the survey questions. Students on a 504 plan, specific to students with disabilities who need accommodations but do not qualify for special education services, were not included because 504 plans are governed by a different set of laws. Student participants represented a 60/40% split of male-to-female, which, along with racial/ethnic composition of the sample, generally reflected the overall population of students with disabilities at the school (Table 1).

Table 1

Demographics of Student Survey Participants

Sub-category	Student Participants	Participant Representation	School SWD Representation *
Male	18	60%	56%
Female	12	40%	44%
White	24	80%	96%

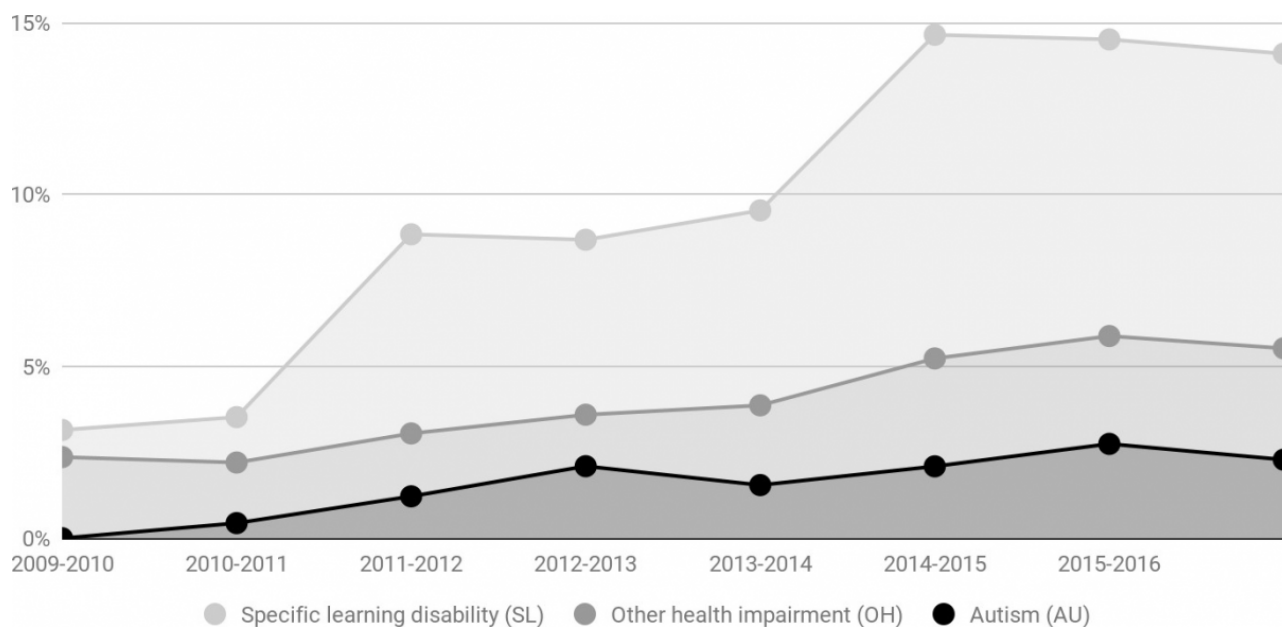
Sub-category	Student Participants	Participant Representation	School SWD Representation *
Hispanic or Latino	3	10%	12.5%
American Indian or Alaskan Native	2	6.7%	0.5%
Hawaiian/Pacific Islander	1	3.3%	0.3%

* Race/ethnicity percentages may exceed 100% because some students identify as multiracial.

Given the stark rise in enrollment of students classified with disabilities at the school, further understanding of these classifications is warranted. There are 13 special education student codes or classifications used to identify specific disabilities: autism (AU), emotional disturbance (BD), speech/language impairment (CD), deaf/blindness (DB), developmental delay (DD), hearing impairment/deafness (HI), intellectual disability (ID), multiple disabilities (MD), other health impairment (OH), orthopedic impairment (OI), specific learning disability (SL), traumatic brain injury (TB), visual impairment (VI). At this school, three of the classification categories, (1) autism, (2) specific learning disability, and (3) other health impairment, currently represent 93.7% of students with disabilities and 14.1% of the student population generally (cf., Fig. 1). When the percentage of students on an Individualized Education Program (IEP) at this online school is viewed through the lens of the distribution of students in the separate classifications, the difference between the school, state, and national averages becomes even more disparate, showing uncommonly high percentages of students classified with autism (+8.6% above state and +7.2% above national averages), specific learning disabilities (+6.9% and +22%), and other health impairments (+13.2% and +8.5%). This is in part explainable by lower comparative rates for students at the school classified with speech and language impairment (-19.2% and -18.5%).

Figure 1

Enrollment of Special Education Students at the Online School by Classification



Instrumentation and Rigor

Built in the online survey platform Qualtrics, the cross-sectional survey for this study was developed over a two-year period that involved think-alouds with experts and potential participants, piloting, member-checking, colleague reviews, and other feedback mechanisms, because, as Lynch et al. (1986) argued, validity must be developed over time through diligence, attention to detail, and ongoing investment in the process. The final survey consisted of one general, open-

ended question, seven Likert-scale type (ordinal) questions, and seven follow-up questions for the ordinal questions to allow participants to further explain their responses.

The initial, general open-ended question was worded as follows: "What is the main reason you decided to attend [this online school]?" Responses were analyzed qualitatively to determine common themes between responses as well as overarching themes. We elected to begin with this question because it most closely mirrored our guiding research question and allowed our respondents to express themselves freely with limited guidance from the survey prompts.

The seven items were then provided on a 4-point, non-neutral scaling, including options of "Strongly Disagree," "Disagree," "Agree," and "Strongly Agree." Results were recoded to numerical values of -1 (strongly disagree) to 1 (strongly agree). The seven questions included the following:

- *Flexibility*: "I chose to attend [this school] because of the flexible"
- *Online*: "I chose to attend [this school] because it is "
- *Teacher availability*: "I chose to attend [this school] because the teachers are available to help them."
- *Curriculum*: "I chose to attend [this school] because of the class lessons (What is taught in the classes.)"
- *Parent as decision maker*: "I chose to attend [this school] because my parents made "
- *Previous poor fit*: "I chose to attend [this school] because our previous school was not a good fit."
- *Laptop*: "I chose to have my student attend [this school] because they got a laptop to " To ensure internal consistency, we calculated Cronbach's alpha on results. The resulting value was .71 (for students) and .7 (for parents), which is generally considered as "acceptable" in social science research situations (Bruin, 2006). Data were then inspected visually and descriptively, and question-to-question correlations were tested to determine relationships.

Following each scale item, a follow-up, open-ended question was also provided with unique wording to provide the participant with an opportunity to explain what their ordinal response meant, such as "Describe your experience with teacher availability." Responses to these questions were also analyzed qualitatively in light of developed themes from the initial question and in a manner that allowed identification of additional emergent themes.

Data Collection

The target population for the survey was the families of students with disabilities who attended the school for at least one year. To reduce coverage and sampling error, the survey was sent to all families that met the above criteria (Creswell, 2008).

The survey was administered using a three-phase procedure over a three-week period. The first emails were sent with a one-week response request, consistent with established school protocols. Non-responders were sent a second survey request the next week, and auto-texts were sent as well to reduce nonresponse error. IEP case managers, who communicated regularly with the students and parents, also provided verbal and text reminders to complete the survey. Each participant was a parent or a student at this school and was therefore accustomed to receiving and

participating in a variety of surveys online. Surveys were sent out via email in the late spring, summer, and start of school, and were made available at student orientation. The student survey was distributed to 58 students with disabilities, and thirty students completed the survey, for a response rate of 52%. The parent survey had an identical response rate, representing 29 responses from 56 parents. The response rate was deemed appropriate given that it was higher than response rates commonly achieved in email-based and mail-in survey designs (Patten, 2001). Several students and parents were invited to participate in follow-up interviews, described in a separate article (Tonks et al., 2020).

Positionality

The first author for this study was the principal of the online school, while the second and third authors were university researchers unaffiliated with the online school. As such, the lead researcher has been deeply involved in advocating for special education students and their educational well-being. While this level of involvement provided her with many insights and advantages in conducting this study, it also required that she carefully consider how her role and position affected how she carried out the research. This required sensitivity and recognition of limits to objectivity, but also served a vital purpose in the implementation of the study, because parents and students, who had developed strong, positive relationships with her over time, felt more comfortable sharing their experiences with her than they likely would have with an unknown third party.

An examination of “researcher subjectivity” (Maxwell, 2013, p. 124) or researcher bias in conjunction with the unassociated second author allowed the first author to thoroughly explore and reflect upon the issue, which is the best way to counteract bias. As the principal of the school, she had a vested interest in ensuring that the needs of families and students were being met, and her assumptions in conducting this research were influenced by prior surveys that included a 97% satisfaction rating with the school overall (Mountain Heights Academy, 2016). The second author, however, had no prior experience with the school and played the role of objective outsider to help ensure that the first author’s assumptions were being challenged and that her interpretations were valid given the evidence provided.

By leveraging the benefits of both positions, we were able to capitalize on existing relationships with participants as well as insider knowledge of their experiences and the culture of the school while also benefiting from methodical doubt and outsider skepticism. We believe this counter-positioning of researchers helped to ensure a final study that was authentic and well positioned but also critical and analytic.

Results

The first question of the survey was open-ended and asked, “What is the main reason you decided to attend [this school]?” Responses were qualitatively coded, and two main themes emerged: (1) *prior experiences* and (2) *learning environment*.

Prior Experiences

Regarding *prior experiences*, 73% of students cited reasons related to (a) bullying, (b) teachers, (c) academics, and (d) disability/health. Five students indicated they had been bullied at their previous schools and were looking for an escape. These comments were very similar in nature: “I got bullied a lot,” “kids were not kind to me,” “a bully picked on me for no real reason,” “to stop dealing with bullies,” and “no bullying.” Thus, multiple students indicated they chose the school to get away from negative interactions with others and to not be bullied while at school.

Four students referenced teachers as a reason for looking at the school. One student said, “The special ed department at my previous school was bad.” Another student said they were looking for “great teachers,” and two shared that they were specifically interested in getting more teacher help. Five students mentioned academic pieces of the education experience as motivating factors for selecting the school. One student shared that they “didn’t like endless homework” while another said he had a hard time keeping his grades up. Two students referenced the school’s academic reputation saying, “it is a good option” and “a great school.” Three students had specific disability-related or health issues such as cerebral palsy, anxiety, and recovery post-surgery that prompted them to consider an online option. One student shared, “Anxiety and health issues made going to school difficult and I needed a school that could follow me home when I was recovering.” Another said that learning at home helped her hips from being sore due to surgery.

Learning Environment

Regarding the *learning environment*, 93% of responses indicated that a change in the learning environment was a major driver for the students, in terms of *when* (meaning the flexibility or the schedule of when the student was learning), *where* (meaning the location the learning was taking place), and *how* (meaning how the instruction was delivered to the student online) learning occurred. Four students mentioned the timing of when they did their schoolwork with three students specifically mentioning having “more time” in general and another student explaining “I have more time to think.” Another student indicated that he was a night owl and appreciated being able to complete his coursework in the evenings.

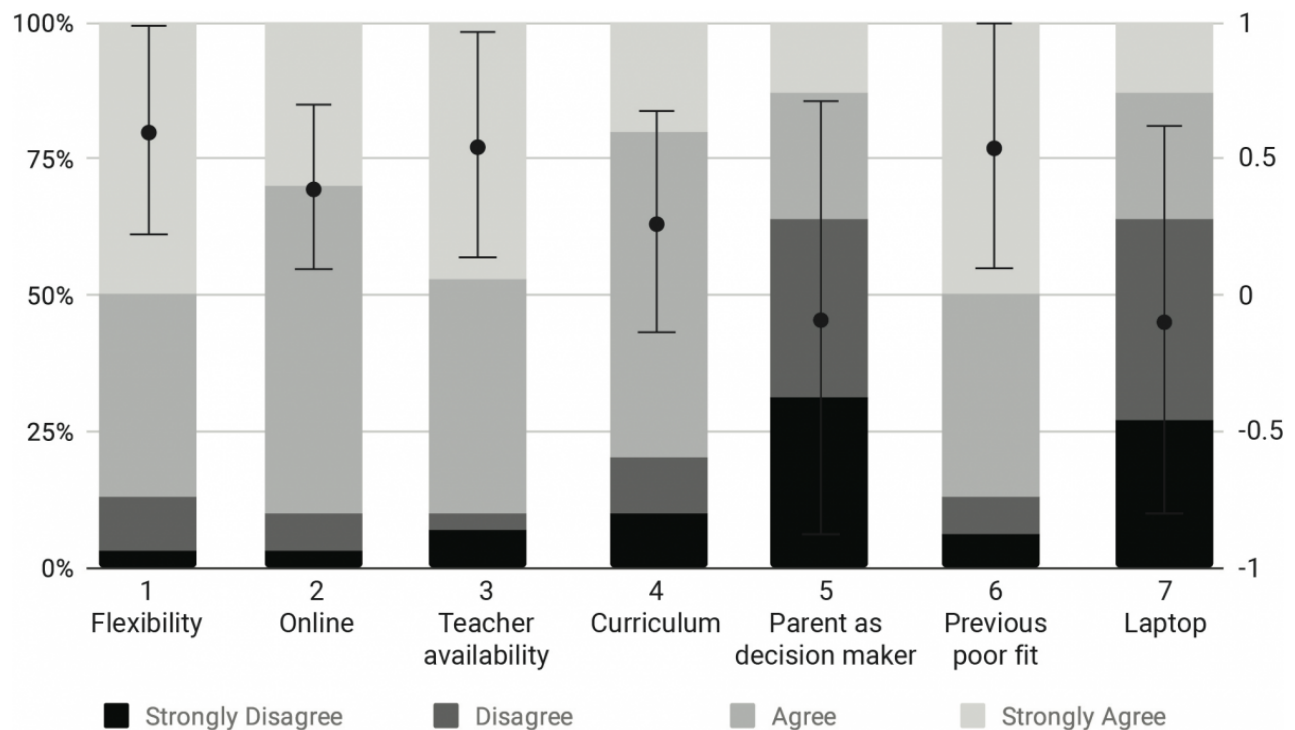
Six responses discussed the *how* of the learning environment in terms of level of comfort, location, fewer distractions, and attendance issues. For example, one student shared that he was more comfortable doing school online and another stated, “I can’t be trusted to be in a school because I would ditch a lot.” One student said he needed fewer distractions, while another said, “I was having a hard time at the school building and online was a lot easier for me.” Five students included comments about the flexibility to go at their own pace and one mentioned being able to work in his pajamas and another on the ability to “do it anywhere.” Two students said they just wanted a change or to try something new. Taken together, such comments reveal how complex affordances of the learning environment in terms of *where*, *when*, and *how* appeal to students in multiple ways and are necessary for finding learning experiences that work for them.

Collectively, such comments revealed that students were looking for a safer, more accessible option for learning, and the target school provided these opportunities by providing online learning experiences, devoted teachers, and flexibility.

After completing this first question, students answered each of the six Likert-scale questions and were prompted to explain their thoughts and feelings regarding each response. Comments were again coded qualitatively. Descriptive survey results of Likert-type questions revealed that responses were generally affirmative, with *previous school not a good fit*, *online*, *teacher availability*, and *flexibility* being the most affirmative and *Laptop* being the least (see Figure 2).

Figure 2

Student Survey Response Distributions by Response Percent (left axis) and Averages and Variance (right axis)



Magnitude of responses indicated that the three most important reasons for choosing the school were flexibility, poor fit at previous school, and online school. Examples of each of these are also provided in Table 2.

Table 2

Themes from Student Survey Open-Ended Comments

Prior Experiences

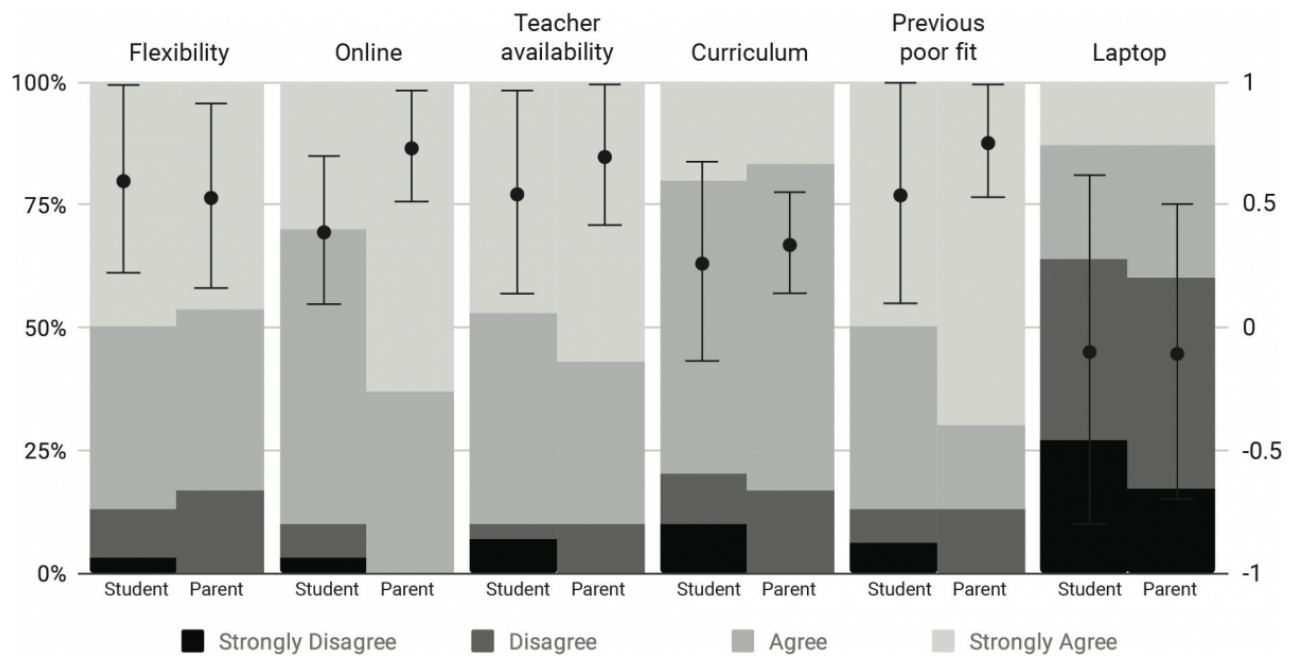
Sub-Theme	Instances	%	Example Comment
Bullying	10	6.76%	"I got bullied a lot."
Personnel	13	8.78%	"The special ed department at my previous school was bad."
Academics	12	8.11%	"I didn't like endless homework."
Disability and Accommodations	7	4.73%	"They were not willing to help me with my learning disabilities."
Health Considerations	10	6.76%	"Anxiety and health issues made going to school difficult, and I needed a school that could follow me home when I was recovering."
When (Schedule/Flexibility)	26	17.57%	"I can see [course materials] whenever I want."
Where (Location)	29	19.59%	"I can do it anywhere."
How (Online/Support)	41	27.70%	"I have more time to think."

Parent Responses

To triangulate and enrich these results with other data, we also collected survey responses from parents ($n = 29$) and analyzed results in an identical manner. Likert-scale responses between the two groups were descriptively very similar, showing that the motivations for students shifting to the online school were generally shared with their parents (Fig. 3), with the greatest difference appearing on the *Online* question. Anecdotally, this difference seemed to emerge from some students not wanting to leave some positive social relationships they had at their previous schools.

Figure 3

Student Survey Response Distributions by Response Percent (left axis) and Averages and Variance (right axis)



Thematic analysis of open-ended responses from parents corroborated thematic results from students but provided additional richness and insight into students' previous experiences. Table 3 includes example comments that show the depth of these issues along with their prevalence in parent responses.

In addition to corroborating themes from student responses, two new sub-themes emerged from parent responses that were previously absent: *lack of support* and *self-determination*. *Lack of support* was organized under the *prior experiences* theme and included instances where parents felt that school personnel were not working with them to address child needs. Three parents shared that there had been poor treatment of their children by their previous school's staff, which was communicated in terms of lacking (a) helpfulness, (b) caring, (c) trust, (d) responsiveness, and (e) understanding.

Self-determination, defined as the ability to make decisions for oneself, was organized under the *learning environment* theme and included instances where parents felt that their students had more of a voice and power to control their own learning. One parent said that her son chose the online school "to have more of a voice with his education," a sentiment echoed by a second parent.

Table 3

Themes from Parent Survey Open-Ended Comments

Prior Experiences

Sub-Theme	Instances	%	Example Comment
Bullying	23	9.83%	The child "had been physically assaulted at school several times."
Personnel	19	8.12%	"Laws were broken, and then my child faced harassment from the SpED Director and Principal."
Academics	21	8.97%	"He was struggling with reading so bad and it was affecting EVERYTHING else."
Disability and Accommodations	22	9.40%	"The teachers didn't understand her autism or emotional needs."
Health Considerations	21	8.97%	"Our fun-loving son had a mental breakdown from the stress and he needed something different. He was sick every day in anticipation of

Prior Experiences

			school.”
Lack of Support	18	7.69%	The school had video evidence of the child being kicked on the ground by a group of boys, and “nothing was done.”
Learning Environment			
Sub-Theme	Instances	%	Example Comment
When (Schedule/Flexibility)	19	8.12%	The child benefits from “the ability to work on school outside of school hours if needed.”
Where (Location)	36	15.38%	The child “has fewer distractions and a quiet place to work.”
How (Online/Support)	38	16.24%	“She can go at her own pace.”
Self-Determination	17	7.26%	The child chose the online school “to have more of a voice with his education.”

Discussion and Conclusion

All public schools, including online schools, have an obligation to meet the needs of their special education students. The number of special education students in online schools is increasing, yet relatively few studies exist that give voice to and shed light on special education students’ experiences in online schools. In this study, the authors analyzed survey responses from special education students at an online charter school and survey responses of their parents to understand why students had chosen the school and how it was working for them. It is possible that there was selection bias among those who chose to participate. The survey was not sent to students who had chosen to leave the school. As with all smaller studies, the findings may not be generalizable. More research is needed to understand student experiences in and motivation to attend online schools. Despite the limitations of the study, the authors believe the findings are valuable for educators, educational administrators, policy makers, and instructional designers.

First, it is clear from these results that students and their parents were drawn to this online school for a number of reasons stemming from both prior experiences and affordances of the learning environment, but those who found success at the school emphasized relationships with school personnel as being paramount for student success. Previous studies have indicated that students, parents, and teachers chose online charter schools both to flee negative environments and to take advantage of online schools’ flexibility and convenience (Ahn, 2011; Beck et al., 2014; Hasler-Waters et al., 2014; Macy et al., 2018). Similarly, our survey results showed that students had left schools where they had experienced bullying, struggled academically, lacked adequate support, and did not receive legally mandated accommodations, and chose instead the online school because of its flexibility, teacher availability, and support. Given families’ negative prior experiences, an online school—with its accompanying decreased social interaction and physical access to bullies—represented a promising alternative to families trying to provide for their children’s needs.

But though such withdrawal from abusive or negligent relationships in brick-and-mortar settings is understandable, these students and their parents further sought, expected, and appreciated focused support, high levels of teacher availability, and flexibility for their individual circumstances, and many of them had tried other online alternatives before finding this one that worked for them. This is noteworthy because many pushes for online schooling in the U.S. today seem to be primarily motivated by interest in decreasing costs and student-teacher interaction, often resulting in higher student-teacher ratios (Burdette et al., 2013; Hasler-Waters et al., 2014; Molnar et al., 2019). Yet, in this school, teacher availability and responsiveness were often cited in survey responses as the most valuable school elements, making it “an answer to a prayer” for many parents. The school in this study had a relatively low student-teacher ratio of 1:19.5, which is much lower than many online schools and also many of their brick-and-mortar counterparts, and teachers were specifically hired, trained, and encouraged to be continually engaged in outreach and support efforts to their students and their families.

The implications for practice are that for online schools to successfully meet the needs of special education students, these schools must not only provide a safe, flexible learning environment, but also provide teachers who are capable, available, and supportive. Teachers need training both in teaching online and in implementing IEPs. Online teaching requires a different skill set from in-person teaching (Ahn, 2011; Pulham & Graham, 2018), yet most states lack endorsements or certification in online teaching (Basham et al., 2015). States should offer certification and endorsements in online teaching. Schools should implement appropriate student-teacher ratios, teacher training, and support. Teachers must understand how to meet students' special needs online, and their legal responsibility to do so (Cavendish et al., 2020; Kozleski, 2020; Macy et al., 2018; Rice & Carter, 2015).

Second, curriculum matters. To meet diverse needs, instructional materials should be designed according to universal design principles (Betts et al., 2013; Macy et al., 2018; Singleton et al., 2019). In this study, students were generally favorable toward the curriculum but also mentioned that not all materials were created equal. Though this may seem obvious, it is an important point to emphasize, because most online schools rely entirely upon third parties for curriculum delivery (Crouse et al., 2016; Greer et al., 2014; Rice & Carter, 2016). Though using commercial curriculum by itself may not be predictive of overall curriculum quality, it can be very limiting for teachers when seeking to teach students with disabilities and other special needs, and it also limits the school's ability to engage in developmental evaluation and continuous improvement practices.

Though some areas of the curriculum at the target school may be in need of revision and improvement, it at least can be improved upon and adapted to specific learner needs because it is based on open educational resources (OER), which give teachers and other school personnel the power and ability to engage in such an improvement process (Geith & Vignare, 2008). This is not so for online schools that rely upon proprietary curricula, which teachers cannot edit, adapt, update, or improve upon and over which teachers and schools have limited control. As Basham et al. (2015) noted, "the flexibility of digital learning materials, when combined with appropriately designed online delivery systems and instruction, can address the variable learning needs of elementary and secondary students with disabilities in ways difficult or impossible to otherwise achieve" (p. 12). By taking approaches that emphasize the teacher's role as a curriculum developer, adapter, and remixer, online schools can both assist in re-professionalizing teachers as content experts and empower them to engage in the types of intense customization necessary to meet the needs of diverse learners (Kimmons, 2016). The implication for online schools is that to meet the needs of students with special needs, schools must use high-quality, accessible curricula, and that may mean creating or adapting curricula.

And third, it is clear from this analysis that the pull toward online education for these students and their parents had little to do with the technologies themselves. Most cared little that a laptop was provided, or the laptop was seen as merely a perk or an enabling mechanism for the solution that they were truly looking for. The implication is that online schools must provide much more than laptops to their students. Rather, as Seymour Papert argued against technocentrism nearly 30 years ago, we should not think about technology as "having an effect" on education but as an "opportunity offered us ... to rethink what learning is all about, to rethink education" (1990, para. 5).

For the families in our study, their prior school experiences were dissatisfactory. Had they enrolled in an online school that merely replicated brick-and-mortar settings or (worse) that assumed that a technology, program, or canned curriculum itself would somehow meet their needs, then they may have been further frustrated. Instead, in the online school that served as the setting for this study, families found a learning approach that was safe, customized, supportive, caring, and self-determined. As one parent later explained, [my child now] gets the kind of attention that I think every kid should be able to get in school. It's a shame the other schools can't deliver it because they're overburdened and can't figure out how to make it happen.

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Proctoring Software in Higher Ed

Prevalence and Patterns

Royce Kimmons & George Veletsianos

Education

Higher Education

Software

How common is the use of remote proctoring among North American colleges and universities? Should the higher education community be concerned?

Driven by the proliferation of online learning and by institutional use of remote and blended forms of teaching and learning due to the COVID-19 pandemic, higher education institutions are placing an increased emphasis on remote proctoring technologies. But do we know how common the use of remote proctoring is among North American colleges and universities?

The answer to this question matters for students, faculty, staff, and administrators and is important for practical, scholarly, and ethical reasons. Practical reasons include the fact that academic integrity is at the core of the operations of higher education institutions. In addition, since higher education practitioners often learn from, reflect on, and evaluate the activities of their peers, understanding the preponderance (or not) of such tools may inform institutional practices. The answer is critical for scholarly reasons because it enables researchers to develop a better understanding of the landscape of educational technology use in higher education and because the evidence for the effectiveness of these technologies—or for the degree to which academic misconduct may be more likely in online settings—is inconsistent. Equally importantly, the answer to this question is important for ethical reasons that go beyond the discipline of educational technology. Specifically, many faculty, students, and administrators have critiqued proctoring tools and have expressed significant concerns about their use to monitor students' behavior. For instance, the Electronic Frontier Foundation has gathered a long list of student petitions against the required use of these technologies, and the students' concerns have been reported in the popular press.¹

Meanwhile, the proctoring software industry advances a narrative—evident in the websites of these proctoring companies—that such tools ensure academic integrity by deterring academic dishonesty and verifying that test and assessment results are valid and reliable.² In short, as Steve Kolowich argued in 2013, proctoring software companies are "hired by universities to police the integrity of their online courses."³ Critics of such tools view them as not only unethical but also largely unnecessary, pedagogically bereft, and inequitable and as something that causes various stressors for students. Critics further argue that proctoring software is better described as a set of surveillance tools that foster a culture of distrust and are grounded in bad-faith views of students' honesty and integrity.⁴ Much of this important critique has been presented in detail in a recent teach-in, [Against Surveillance](#), "about surveillance, educational technologies, academic freedom, and student care."

If proctoring software is truly harmful, understanding the extent of its adoption—the prevalence and patterns—is imperative, since this information may allow estimates not just of expenditures but also of potential harm.⁵ Yet very little literature is available to indicate how many colleges and universities make use of these technologies. A November 2020 *Washington Post* article noted that "thousands of colleges in recent months" had been using proctoring software.⁶ The proctoring company Examity indicates that "more than 500 colleges and employers use its services," and another proctoring firm, ProctorU, notes that it works with over 1,000 institutions.⁷ Other proctoring companies state, on their websites, that they have proctored many millions of tests.

In April 2020, EDUCAUSE conducted a QuickPoll about grading and proctoring. Findings showed that about half of the 312 respondents reported using online/remote proctoring tools. Five services dominated the market for proctoring software: Respondus (65%), ProctorU (23%), Proctorio (17%), Examity (12%), and HonorLock (12%).⁸ While these findings are valuable and enable us to begin to make sense of the range of popular solutions, and potentially of the scale of use, the representativeness of the survey, sample size, and granularity (e.g., at the state or provincial level) may limit the usefulness of its results.

A Wider View

We wanted to take a wider view. Building on the work of EDUCAUSE, we used the Google Custom Search Application Programming Interface and a list of 2,155 college and university websites in the United States (n=1,923) and Canada (n=232) to determine how widely these tools and services were being used. If a college or university subscribed to one of these proctoring services, we assumed that it would reference the service somewhere on its website, so between November 13 and November 18, 2020, we searched each website for unique terms associated with the top five services (e.g., "proctorio," "respondus") and noted the number of results. We also checked the first ten results for each institution to ensure representativeness of the query—in either page titles or summary snippets—to confirm precision, and we considered each site that returned at least one validated reference to a proctoring service as representing some level of adoption. Each site returned between 0 and 3,290 results for each term, showing that in some cases, mentions of proctoring software at educational institutions seem to be highly active.

To evaluate whether results actually indicated adoption, we read through 100 randomly returned results and found that they included the following:

- Explanations of an adopted service (e.g., "Honorlock is an online ID verification and proctoring tool.")
- Explanations of how to use a service (e.g., "Guide for Selecting Settings for Proctorio")
- Announcements for training webinars on a service (e.g., "Accessing Examity")
- Information on how students can sign up or pay for a service (e.g., "Examity. Proctoring Fee: \$25; all major credit and debit cards accepted.")
- System requirements for a service (e.g., "Students interested in taking the Accuplacer through Examity must have a computer that meets Examity/Accuplacer requirements.")
- Links to a service (e.g., "Blackboard Tests; Proctoring with Respondus; Blackboard Journals")
- Mentions of a service on a purchase list (e.g., "Examity" being included on a list of "Available Services for Faculty")

Of these 100 results, 4 did not clearly reveal that the institution had adopted the service, but upon further examination of these exceptions, we discovered that all 4 institutions had indeed adopted the mentioned service. We took this to indicate that results were reasonably reliable to show institutional adoption.

We also noted that of these 100 results, none took a critical stance toward proctoring tools or addressed the ethics of student surveillance. To check this, we also did a keyword search on all results to explore how many included the words "privacy" or "surveillance" in their title or summary snippet. We chose these two keywords because their use might indicate a critical approach to these tools. We found that less than 1% included one of these keywords, which suggests that virtually all results approached these tools in a neutral, detached, or supportive manner.

Of course, institutional websites are often massive, representing tens or hundreds of thousands of pages and various internal groups with their own subscriptions, licenses, and approaches to educational technology software. Thus, the mention of "ProctorU," for example, on an institutional website may suggest adoption of the service by one or more entities within the college or university, but it does not mean that the entire campus uses the service or that it has purchased a site license. In fact, in many cases, costs for proctoring services are directly paid by students to the servicer.

Context for Further Discussion

Our results show that nearly 63% of colleges and universities in the United States and Canada mention proctoring software, indicating use. Our numbers generally align with the QuickPoll results from EDUCAUSE, but they also provide more nuanced results by state or province. Overall, colleges and universities in the United States were more likely to use one of these services than their counterparts in Canada (see table 1).

Table 1. Mentions of Proctoring Software on US and Canadian College and University Websites

	Any	Respondus	Proctorio	ProctorU	Examity	HonorLock
United States and Canada	62.9%	52.4%	19.6%	25.7%	18.0%	7.7%
United States	65.8%	54.9%	21.2%	27.8%	18.4%	8.4%
Canada	39.2%	31.9%	7.3%	9.1%	14.2%	1.7%

In Canada, of the four largest provinces, Quebec seems to be an outlier. While mentions in Ontario, British Columbia, and Alberta range from about 69% to around 77%, Quebec's use is only around 8.9%. On the other hand, in nearly 90% of US states, more than half of the institutions mention these services (see figure 1).

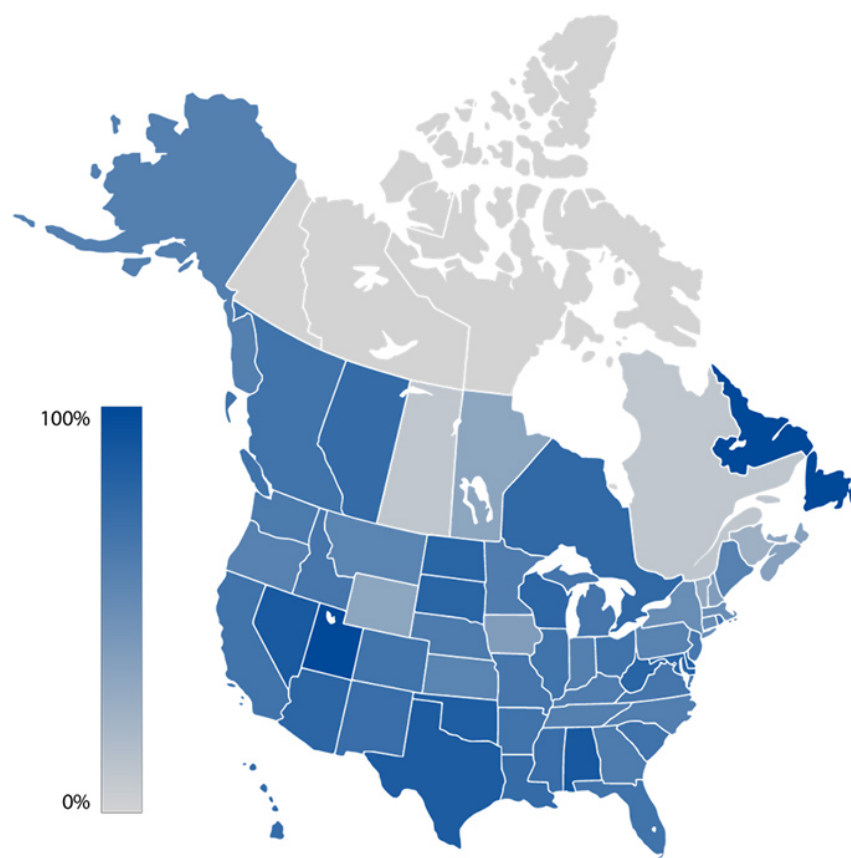


Figure 1. Representation of Proctoring Software on College/University Websites by State or Province

These results indicate that proctoring tools and services are becoming increasingly ubiquitous among higher education institutions in North America—though more so in the United States than in Canada. Yet although they confirm broad use, these results do not reveal the degree to which these tools are used within institutions or other nuances around their adoption. For instance, while some institutions might adopt these tools for courses that require external accreditation, others may adopt them for all courses that require exams. Furthermore, while these technologies share similarities and concerns, choices between them also encompass ethical dimensions. The University of Victoria in British Columbia, for example, reports that it does not approve "the use of artificial intelligence / surveillance proctoring tools, such as Respondus Monitor or Proctorio," but it does support the Respondus LockDown browser in its broader efforts to secure examinations.⁹

Since the ongoing COVID-19 pandemic seems to have caused a spike in adoptions of proctoring tools,¹⁰ the higher education community should take extra care when implementing these tools as part of normal practice. Martin Weller explains that when institutions invest significant resources (e.g., money, expertise, processes, training) to embed a technology into their operations, such software becomes integral to operations, resulting in *software sedimentation*—a term he borrowed from Jaron Lanier.¹¹ He notes that an unintended pedagogical outcome of such sedimentation is "tool-focused solutionism," which encourages individuals to look to particular technologies for solutions (e.g., "How can [SurveillanceTool] aid integrity in our classrooms?"), rather than process-oriented and practice-oriented solutionism (e.g., "How can we adjust our pedagogies, assessments, and relationships with students to aid integrity in our classrooms?"). Importantly, sedimentation also makes it very difficult for institutions to extract themselves from particular technologies. Simply canceling annual contracts is not enough, since the internal processes designed to support such technologies amount to long-term investments in them (e.g., training hundreds of faculty to use particular tools means that an institution is now invested in that tool in numerous ways).

Given the prevalent nature of these technologies as indicated by the results of this study, we urge individual faculty and institutional leaders to consider the long-term implications of these adoptions in response to the challenges of the

COVID-19 pandemic and the very real possibilities of long-term frustrations. We also encourage further research to investigate the ways in which—and the degree to which—these technologies are being used. Data for this research will likely need to come from the higher education institutions, since the proctoring software industry, similar to the broader educational technology industry, lacks transparency in this respect. For instance, even basic metrics (e.g., lists of institutional adoptions) are unavailable on proctoring company websites, which also do not provide access to third-party researchers who might want to evaluate the company claims and technologies.

Our review is an early look. Our findings should provide ongoing context for debates around student surveillance, security, rights, and privacy and should offer added urgency for institutional leaders and policymakers to take these matters seriously. As proctoring tools and services are being adopted at institutions serving millions of students, the higher education community needs to responsibly grapple with the implications of this use, reflect on how these shifts respond to actual needs, evaluate the costs of these shifts (in terms of money, privacy, and distrust toward students), and consider whether adopting such tools so quickly and broadly is the best solution to the problems we are trying to solve.

Notes

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2. See Colleen Flaherty, ["Big Proctor,"](#) *Inside Higher Ed*, May 11, 2020. [Jump back to footnote 2 in the text.](#) ↩
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10. See Jeffrey R. Young, ["Pushback Is Growing Against Automated Proctoring Services, But So Is Their Use,"](#) *EdSurge*, November 13, 2020. [Jump back to footnote 10 in the text.](#) ↩
11. Martin Weller, *25 Years of Ed Tech* (Edmonton, Alberta: Athabasca University Press, 2020). See also Jaron Lanier, "The Complexity Ceiling," in John Brockman, ed., *The Next Fifty Years: Science in the First Half of the Twenty-First Century* (New York: Vintage Books, 2002). [Jump back to footnote 11 in the text.](#) ↩

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Putting Your Best Self Forward

6 Keys For Filming Quality Videos

Jered Borup

Learning Design

Asynchronous Video

Instructional Video

People tend to get nervous when they are new to recording themselves. They seem to believe that to look and sound professional, they need professional equipment. Having worked in studio environments such as the one in figure 1 with [Joan Shin](#), I know that professional-grade equipment can result in more professional videos. However, I also know that the cameras on webcams and smartphones have become quite good, and you can make great looking and sounding videos with the technology you already own, as shown in figure 2. While technology is important, it's much more important to know how to use the technology well.



Figure 1. Joan Shin's video environment

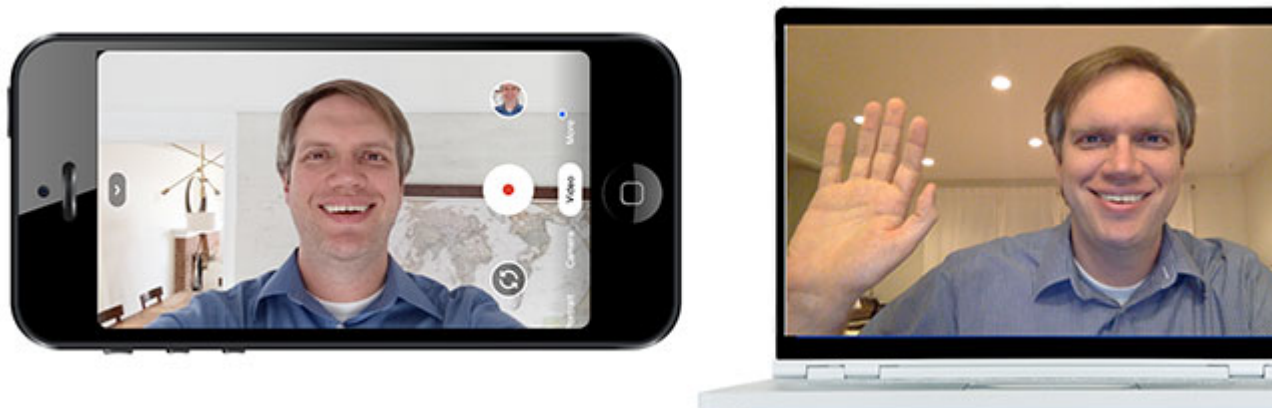
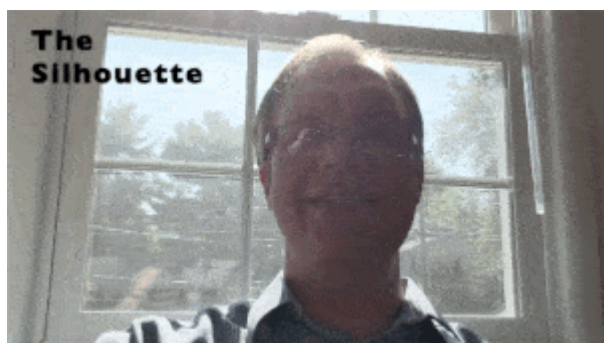


Figure 2. Jered Borup's video products

What Not to Do

Before we talk about best practices, let's cover what not to do. The GIFs in table 1 are exaggerated for effect, but not by much. I think it's safe to say that we have all been guilty of at least some of the following what-not-to-dos.



The Silhouette: People commonly record videos while sitting in front of a window or a lamp. When you do that, others may only see your silhouette.



The Zebra: If natural light is available, it is best to sit facing that light—so long as the window blinds do not cast shadows on your face. Stripes look better on tigers and zebras.



The Haunting: At times we may want to record a video at night. However, be careful because the light from your screen can make it look like you're telling scary stories by the campfire.



The Hostage: Video can be a great opportunity for others to get a glimpse into where you live or work. Too often we don't take advantage of that opportunity and record videos in front of a blank wall. As [Room Rater](#) frequently points out, these recordings can feel like a hostage video, as if at any time the person is going to look if the coast is clear and then whisper, "Help me!"



The Nosey Professor: It's convenient to work with our laptops on...well, our laps. However, looking down at your laptop is a less-than-flattering angle, and you can even give students an unforgettable look up your nostrils.



The Toddler: Just as looking down on the webcam is less than flattering, looking up at the webcam looks like you need a booster seat.



The Close Talker: Some people are just close talkers. [An entire episode of Seinfeld](#) covered the topic. Just like in-person close talkers invade people's personal space, online close talkers can get too close for comfort.



The Social Distancer: If The Close Talker is on one end of the spectrum, The Social Distancer is on the other. Social distancing is important during a pandemic, but is unnecessary online.



The Reader: When we create a video we may feel tempted to watch ourselves or read a script on the screen rather than looking into the camera. This prevents us from creating eye contact and can make us look uninterested or inauthentic.



The Profiler: First-world problems, I know...but if you have two monitors you may find that you spend too much of your video looking at the monitor that is not recording the video. This will leave people staring at your profile. This is more common in live video calls but can still happen when recording videos.



The Needs a Trim: Once we've finished talking, our smiles often vanish as we look for the stop button. Some tools will allow you to trim the ends of the video, but if not, keep smiling until you actually stop the recording. Niccole Thurman perfectly highlighted this in her [tweet](#).

What to Do

I went back to my YouTube channel and found my first webcam video (Aug. 31, 2010) and then compared it to a more recent video (June 20, 2020). It's not by accident that the newer video looks better than the older one (see figure 3). In the first video, I failed to consider (or care) how I was going to appear to my students. I was backlit by the lamp behind me. I was looking down on the laptop. In fact, I didn't even bother holding my laptop level, which made the picture in the background appear tilted. I wasn't even really looking into the webcam, although there was so much glare on my glasses it's hard to tell.

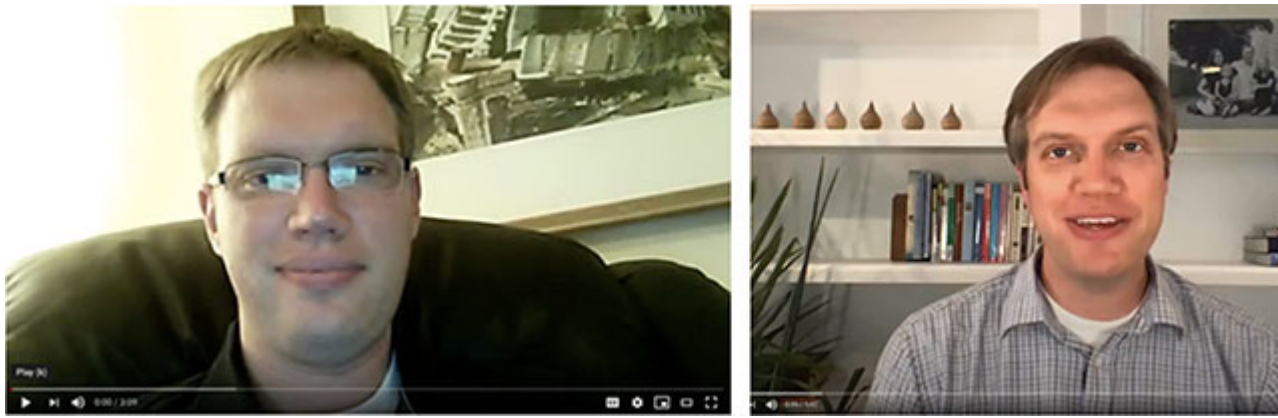


Figure 3. Then and now: How small changes can make big difference in video

In the newer video I took just five minutes to prepare. You can see in figure 4 that I put my laptop on a stack of my daughters' games, which raised the webcam to my eye level. I also used lamps specifically designed for recording webcam videos, though any lamp would work. Even better, you can sit facing a light-filled window. I also made sure that in the background there was a picture of my family, a small plant, and a few other little things.



Figure 4. My home video setup

Keys to Quality Videos

The following simple keys can help you avoid these common pitfalls of amateur video production and create warm, engaging, effective footage that engages your students and communicates your interest them.

Key #1: Convey Your Voice

Looking good is important, but nothing is worse than bad audio. If the audio is distracting or unintelligible, your video will not be watched. If you are recording using your phone while outside, even a little breeze can be really distracting. If the built-in microphone is not great on your phone or computer, try using an external microphone. Most headphones now have pretty good microphones built in.

The audio doesn't need to be perfect, and most of the time, good audio is good enough. However, if you want to go the extra mile, relatively inexpensive high-quality external mics are available, [such as the Blue Snowball](#). Furthermore, if you

are hearing reverberations or echoes from where you are recording, you can improve the sound quality by placing pillows behind and to the sides of your computer, as shown in [this NPR video](#).

Key #2: Find the Light

For lighting, the best arrangement is to sit facing the primary light source in your room rather than having the primary light source behind you. Often the best approach is to sit toward a sun-filled window (if the light isn't so bright it blinds you). If that isn't an option, then lamps will do. If a lamp's light is not strong enough, try removing the lamp shade. An additional lamp can also be helpful if you are sitting directly under a strong light that casts shadows on your face.

Key #3: Frame and Maintain Eye Contact

Sit a little less than arm's length from the camera. From there your eyes should be about one-third of the distance from the top of the screen, as seen in figure 5. You should also position the camera so that it is at eye level (or slightly below). That will likely mean placing your laptop on something like a box or a stack of books.



Figure 5. Establishing an optimal vertical relationship of face and camera

Key #4: Stage

Before hitting the record button, take a few minutes to consider the surroundings that will be shown in your video. Personal items can be a good way for others to get to know you. Furthermore, plants, pictures, and bookshelves can add warmth to the video.

While working from home, it can be difficult to find a place to work and record videos. For instance, in [this CNN article](#) you can see people working everywhere from the closet to the bathtub. However, even Jessica Fleming, who was working in her walk-in closet, presented a professional background: "The best part? I've even hung a picture behind the desk so that my video conference calls don't look like I'm in my closet!" As a side note, a closet is a great place to record audio. [Just don't get locked in.](#)

Key #5: Be Prepared and Natural

Speak naturally, as if you were actually speaking to someone rather than a screen. If you are able to show that what you are saying is important and interesting to you, then others are more likely to feel the same way. You should know generally what you want to say before you start recording. However, in most cases it is not necessary or even recommended to write a script that you read. If you are reading from a script, it can be hard to sound natural and almost impossible to read while you are looking into the camera without a teleprompter. If you have ever taken a public speaking class, you know that a better approach is using notes to prompt you while speaking. If you are recording from a laptop or desktop, you can have the notes in a word processing document. However, even that will require you to look down frequently so try placing your notes as close to the top of the screen as possible. Another trick is to put your prompts on sticky notes that you then place right next to the webcam so you can glance over to them while still appearing to be looking into the webcam.

Key #6: Keep It Short

Unlike with in-person courses, online instructors do not have captive audiences. The entire internet is only a browser tab away, and there is very little stopping others from exploring. If you have mastered all five of the previous keys, you are more likely to keep others' attention, but even that attention will likely be limited to about six minutes for many of your students. This recommendation is based on Guo, Kim, and Rubin's research that examined nearly 7 million video views on 862 videos and found a steep drop in engagement after about six minutes.^{Footnote1} Obviously there will be important exceptions to this rule, but if you can keep it under six minutes—do it!

Conclusion

When creating a video, it is important to consider how you will look and sound to your students. Now that you've learned about the six keys to making quality videos, try making a video yourself or review a video that you've previously recorded. As you watch your video ask yourself these questions:

- **Key #1: Convey Your Voice**—Is the audio clear, or is there background noise or reverberations in the room that distract from your message?
- **Key #2: Find the Light**—Are you well lit with a light source in front of you, or are you backlit and/or have shadows on your face?
- **Key #3: Frame and Maintain Eye Contact**—Are you about at arm's length and eye level with the camera, or are you looking down or up at the camera?
- **Key #4: Stage**—Do you have personal and/or interesting things in the background, or are you recording in front of a blank wall?
- **Key #5: Be Prepared and Natural**—Are you speaking naturally in a way that conveys your interest in the topic, or do you sound somewhat robotic and/or scattered?
- **Key #6: Keep it Short**—Is the video under six minutes?

A little preparation can mean the difference between a video that students watch and one that students ignore.

Acknowledgment

This chapter was written with the support of EdConnect and previously published at <https://edtechbooks.org/-RfL>.

Note

1. Philip J. Guo, Juho Kim, and Rob Rubin, "[How Video Production Affects Student Engagement: An Empirical Study of MOOC Videos](#)," Proceedings of the first ACM Conference on Learning @ Scale, March 2014.

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Teacher, Are You There? Being "Present" in Online Learning

Richard E. West

Online Learning

Technology

Asynchronous Video

What learning experiences have been most substantial in your life? How many of those were special because of the people there with you, assisting you in your journey?

One student, Steven, enrolled in an online program because it fit his work and family situation best. He enjoyed the content of the classes, but mostly he had forgettable experiences and even some frustrating ones. At the end, he could not name any of his teachers or fellow students, and consequently he felt no connection to the university at all—except for one professor. This professor had reached out to him, had conversations with him, and served as a mentor. When Steven graduated, he attended graduation ceremonies mostly to see this one professor, the one who had made a connection.

A common misunderstanding about education is that it is primarily focused on brains, information, and memory. While learning certainly involves attempting to get things to "stick" in our heads, it is much more—it is about change and growth. Education is the learning of new information, yes, but also developing new skills, values, behaviors, feelings (you can "learn to love" for example), culture, and ways of living and interacting with the world. These things are often best learned through relationships, as the Russian psychologist Lev Vygotsky believed, and he argued we first learn things with others before we can internalize them ourselves.

As online education continues to expand, we have learned that effective learning involves human relationships—even if we are not physically together in a classroom. While it is possible to participate in a course in which the student reads a textbook, completes assignments, and takes exams without ever communicating with an instructor, that type of experience is often hollow. Richard Culatta, former director of the Office of Educational Technology for the US Department of Education and current Chief Executive Officer for the International Society for Technology in Education, said, "Learning is inherently social," before adding, "We need to see a shift in using tech less for presenting content and more as a tool to design, create, explore, and connect."^{Footnote1}



**“Learning is inherently social.
We need to see a shift in using
tech less for presenting content
and more as a tool to design,
create, explore, and connect.”
--Richard Culatta**

Video technologies are part of that shift in helping online learners feel connected to teachers and peers. This connection comes from people developing the sense that they are "present" in the class, even if they are not physically in the same room. How is it possible to be present when you are physically separated?

1. Show the Real You

In all human relationships, we feel closer to someone who seems authentic and similar to ourselves. For example, Jimmy Fallon, John Krasinski, and other celebrities were able to expand their popularity during the COVID-19 home quarantines of 2020 by recording their shows at home. Family interruptions, dressing "down," and sneak peaks at their homes ([Jimmy Fallon has a slide!](#)) helped them feel more real and human to their viewers.

As another example, Joe Wicks, [the "Body Coach,"](#) grew astronomically in popularity as he led the world in daily physical education exercises during the home quarantine period. One regular feature of his workout videos was that he would change out the items on the shelves behind him (see figure 1) and invite viewers to guess what was new. He would then describe each item and explain why it was special to him.



Figure 1. Joe Wicks workout at home

For teachers, although it may be inappropriate to share some aspects of our personal lives with students, we can still shorten the distance between us and the students by showing some parts of our authentic selves. One time I was recording a video to my students and my toddler climbed up on my lap, interrupting me. At first I was frustrated by this interruption. However, later my students said, "It's really fun to see you at home. You're like a regular person!" For another example, consider this video of Chris Haskell, a clinical associate professor at Boise State University. How do the items in his background help you understand Haskell as a professional? What about as a person?



Figure 2. Chris Haskell video showing part of his office

Tip! Record videos from different locations in your home, office, or community. While you should be careful not to overdo it, a few seconds showing your personality can make learning fun. As an example, Lloyd Rieber of the University of Georgia recorded introductions to his videos from his farm, sitting next to his favorite cow, before moving on to the

formal instruction parts of the lesson. Years later, students may not remember everything Rieber taught, but they will remember who he was as a person.



[Watch on YouTube](#)

Lloyd Rieber teaching about needs assessment after feeding Anabelle

2. Express (the Right) Emotions

Our eyes, ears, and other senses have evolved to take in a tremendous amount of information each second. Not only do we hear or see what someone has said or shown us; we also notice, unconsciously, details about *how* the message was communicated. For example, a simple statement such as, "I am so happy to see you today!" can carry the opposite meaning if you say it with a furrowed brow, terse tone, rolled eyes, or crossed arms. As another example, animators have become so skillful at using nonverbal communication that an entire story can be told without any dialogue. See, for example, Pixar's popular shorts "For the Birds" or "[Geri's Game.](#)"



[Watch on YouTube](#)

For the Birds

Some teachers are skilled at showing emotion in online videos. They smile, get excited, show surprise, lean closer to the camera, and otherwise talk *to the students* instead of to the camera. Students notice this and feel more connected to these teachers. Consequently they are more likely to reach out to those instructors if they have questions or need assistance and to feel more engaged in the courses. As an example, these two student quotes illustrate the connections that are possible in a class where the instructor used asynchronous video:

"It was like he was having a conversation with me even though I wasn't responding. He was talking to me as if I was right there in front of him."

"It seems like we are actually having that conversation even though we're not."

Meanwhile, other instructors are less skilled at showing emotions in their videos, and they come across as disinterested. Students in these classes do not feel the same sense of connection with their instructors and may even prefer text communication instead.

Tip! Your students will be more connected to you if they feel that you are talking to them directly. When recording your video, look at your camera instead of at your screen and imagine the student(s) you are talking to. They are really there... on the other end of the internet! Also, remember to smile, and greet your students when you begin, before launching into your instructional material.

Tip! Just as we can show positive emotions in a video, we can also easily show negative ones. For this reason, be careful not to record a video while you are frustrated—the students will probably notice and might misunderstand what you are trying to communicate.

Practice! Rewatch a video you record for your class, or ask a friend to watch it and provide you with feedback. Try watching it with and without sound. What emotions do you see, or is your video emotionless? (Remember "[Bueller?](#)" [Bueller?](#)") Are those the emotions you want to express? Now try recording the video again with a different emotional angle. Can your friend pick up the difference? Which would they prefer to see from their instructor?

3. Personalize Your Videos

When we communicate in person, we personalize the way we talk by referring to someone's name, or referencing something we have in common ("Isn't the weather great today? Are you enjoying your walk?"). Using the exact same phrases to talk to everyone, without any variety, would feel awkward. Similarly, in online communications, we can increase the feeling that we are "present" with our students if we customize our communications with them. Undoubtedly, there are times when it is better to be efficient. If most students make the same mistake on an assignment, we might copy and paste a reply to them. If we didn't do this, we might not have time to give them feedback at all, and students appreciate receiving the feedback!

However, when we are trying to establish a connection with students, these canned responses can seem cold and clinical rather than personal. Instead, if we reference shared experiences or specific things about the student we are talking to, that student feels important and understood. For example, an instructor might provide feedback on an assignment by using the student's name and referencing their work or a snippet of a past conversation: "Sara, I remember you said you were from the Midwest, and I loved seeing you reference your hometown in your paper. It made me want to visit! I do have some feedback for you...."

Tip! In large classes, keep a notepad or computer document handy where you can write notes about students so that you can refer to them later. Doing this can help you remember what conversations you have had with which students—it is unlikely that they will forget! Referencing these previous interactions will give the students, and you, a sense of a continuing conversation—one in which they are active participants.

Tip! Sometimes creating video discussions that are not directly related to the content of the class can be really helpful in establishing a positive learning community atmosphere. With in-person learning, teachers will often chit-chat with students before, during, and after class. This casual conversation can be helpful in making students feel noticed and important to the teacher. Online, these conversations need to be created intentionally. Try creating a "chit chat" thread for students to talk to each other and you about off-topic things, or have a weekly thread where you suggest a current-events topic and ask students to record video responses. Be sure to reply to them and continue the conversation! As one example, when the 2020 COVID-19 quarantine began in the United States, I created a thread for students to share short, asynchronous video clips about how they were handling the directive to stay at home, which helped us find the good in the situation. They shared that they enjoyed spending time with family, watching movies, and catching up on sleep, and we developed a greater sense of a shared experience as we talked with each other about the current state of society.

Conclusion

Charles Graham, well known author on blended learning, said, "Many learners want the convenience offered by a distributed environment, and, at the same time, do not want to sacrifice the social interactions and human touch they are used to in a F2F classroom."^{Footnote2} We can increase this sense of the "human touch" in all of our interactions, including through text. However, video has a particular power to convey our humanity. In particular, asynchronous video can provide some of the convenience of online learning without sacrificing the human connection. If we personalize our videos to the students, express emotions, and strive to show them a little of who we really are as people, this can increase the feeling that we are "present" together in the class, even if we are physically separated. This feeling of presence can increase student engagement and satisfaction with the course, as well as students' feeling of connection and appreciation for the instructor.

Acknowledgment

This chapter was written with the support of EdConnect and previously published at <https://edtechbooks.org/-TZma>

Notes

1. Richard Culatta, personal communication, December 21, 2020.
2. Charles R. Graham, "[Blended Learning Systems: Definition, Current Trends, and Future Directions](#)," in *The Handbook of Blended Learning: Global Perspectives, Local Designs*, eds. Curtis J. Bonk and Charles R. Graham (San Francisco: Pfeiffer Publishing, 2006), 9.

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Dr. West's research focuses on developing educational institutions that support 21st century learning. This includes teaching interdisciplinary and collaborative creativity and design thinking skills, personalizing learning through open badges, increasing access through open education, and developing social learning communities in online and blended environments. He has published over 90 articles, co-authoring with over 80 different graduate and undergraduate students, and received scholarship awards from the American Educational Research Association, Association for Educational Communications and Technology, and Brigham Young University.

He tweets @richardewest, and his research can be found on <http://richardewest.com/>



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Understanding How Asynchronous Video Can Be Critical to Learning Success

Richard E. West

Online Learning

Video

Learning

Asynchronous Video

Facebook

When teaching online, instructors often default to using synchronous activities, but asynchronous tools can provide effective learning opportunities in many situations.

"Ugh, I just finished six straight hours of Zoom calls," my exasperated colleague shared on Facebook.

How many of us feel we could win at videoconference bingo because we do it so much?

During the shutdown of in-person education brought on by the COVID-19 pandemic, "Zoom hangovers" have become acute for many instructors. However, this fatigue is not simply a COVID-19 challenge but is a struggle that many online teachers have long felt. As colleges and universities move increasing numbers of courses into online or hybrid settings, many instructors mourn the loss of personal connections with students. After all, most of these professionals chose teaching in part because they enjoy student interactions. They often find it unsatisfying to instead teach to a computer screen, with less of a personal relationship with students.

WORKING FROM HOME CONFERENCE CALL BINGO

You're the first to dial in	"You need to unmute your mic"	"I can see you, can you see me?"	Shock of seeing people in casual clothes
Two people try to talk at the same time	Twice in a row	Three times	"Ok you go first" four times
You hear someone's kids	You hear someone shouting at their kids	You hear someone's dog	"Show us the dog"
Cat jumps up on the desk	Calling from kid's room or hallway	You spend the whole call looking at yourself	"Whats that thing behind you?"

@twisteddoodles

During the shutdown of in-person education brought on by the COVID-19 pandemic, "Zoom hangovers" have become acute for many instructors. However, this fatigue is not simply a COVID-19 challenge but is a struggle that many online teachers have long felt. As colleges and universities move increasing numbers of courses into online or hybrid settings, many instructors mourn the loss of personal connections with students. After all, most of these professionals chose teaching in part because they enjoy student interactions. They often find it unsatisfying to instead teach to a computer screen, with less of a personal relationship with students.

The Benefits and Challenges of Synchronous Video



In an effort to develop that connection, many faculty use videoconferencing software, such as Zoom, Google Meet, or Microsoft Teams, because it most closely approximates the in-person teaching experience. Everyone is together at the same time, and the instructor can present ideas, divide the class into breakout rooms, and talk to students "face to face." Synchronous video teaching—video sessions in which everyone participates at the same time—has some powerful benefits, and it does increase the feeling of immediacy and social presence within a class.

However, synchronous video also has serious limitations and cannot be the answer for all online learning. First, it is not convenient for many students, such as those who are at work during class or who live in different time zones. Many of these students seek online learning to find flexibility in how they learn, and synchronous video limits that flexibility.

Second, long synchronous video sessions can be cognitively tiring. Whereas in-person teaching often involves moments of breaking into groups, walking around the room, transitioning from one class to another, and looking away from the professor to take notes during a discussion, during videoconference teaching, all of these things happen sitting in one position, looking at one computer screen.

If done for too long, videoconferencing is a recipe for physical and mental exhaustion. As Suzanne Degges-White wrote, long videoconferencing meetings can be fatiguing: "From a numb butt to an aching back to a dull, throbbing headache and eye strain, hours spent in one position at furniture never designed for long-term sitting can leave us feeling cranky, achy, and a lot worse about life."^{Footnote1}

An Emerging Alternative: Asynchronous Video

How can instructors create the rich, personal connections that benefit student learning without hours of videoconferencing? One strategy is to use asynchronous video. In contrast to videoconferencing, asynchronous video technologies enable students and faculty to record video responses as part of a discussion but without the requirement that it happen at the same time. This means participants can record their videos when and where they want to. It also

means they can view others' videos at a time and place of their choosing, or they can break up how they view the videos so that they have important breaks in the middle of the conversation.

Besides increased flexibility, asynchronous video discussions have been found to have many other benefits:

- Rich conversation-like exchanges
- Increased social presence and feeling of immediacy in a class
- Improved student motivation
- Stronger faculty/student relationships
- Improved collaboration and sense of "trust" of group members
- Easier and better feedback on performance
- Increased participation from some groups of students, such as introverts, who prefer asynchronous interaction

Various research studies have cited these benefits, but it is important to note that these studies do not show asynchronous video as a panacea. Indeed, some students appear to prefer text-based discussions. This is not surprising—no two students are the same, and they will have different preferences for how they learn. However, asynchronous video clearly can have a powerful, positive effect in reaching students and developing connections with them in ways that text-based discussions cannot, and it can do this in a much more flexible way than synchronous videoconferencing.

How Can Instructors Use Asynchronous Video?

With any new technology, we may struggle at first to see how asynchronous video can be integrated into our daily work lives. However, we can answer the question of when we could use asynchronous video by first asking "When do I want or need to communicate with others?" If those times of communication require efficiency, often text is faster (although not always—we found in our research that at least sometimes extraverts can feel they communicate faster via video and not everyone is a fast typist). However, if you want to build stronger relationships when communicating with others, and if that communication is at a distance, then asynchronous video may be a great solution. For example, Patrick Lowenthal and his co-authors have discussed how faculty can use asynchronous video as part of their teaching in various ways.^{Footnote3} They list the following:

- Present questions to a class for students to discuss
- Give feedback on an assignment
- Check in on students doing internships or experiential projects
- Have students provide a quick update on their progress on a project
- Conduct an asynchronous review session for a quiz where students ask questions via video and the instructor responds via video for everyone to see
- Provide tutorials or screencast demonstrations of concepts or procedures
- Conduct brainstorming or ideation sessions, given that asynchronous video allows more time for people to compose their thoughts, reducing the likelihood of groupthink
- Improve student advising and mentoring through weekly or biweekly updates
- Improve alumni outreach by asking alumni to record quick video summaries of their work in a discipline or answers to student questions
- Increase consensus development on a team by asking each team member to share their independent thoughts on an issue
- Enable collaboration across countries and time zones
- Facilitate listening to diverse narratives around a social issue, collected separately but available for students to view and discuss
- Hold "water cooler" chit-chat discussions, given that apps such as Marco Polo and TikTok have already created a rising generation of students who interact casually through video in the same way their parents interacted through letter writing or email

Michael Moore, a pioneer in the discipline of online learning, once argued that there are three important types of interaction in an online course (see figure 1). First, students interact with each other. Second, they interact with the course materials themselves. Third, they interact with their instructor. These three types of interaction can be a guide to using asynchronous video effectively in online learning.

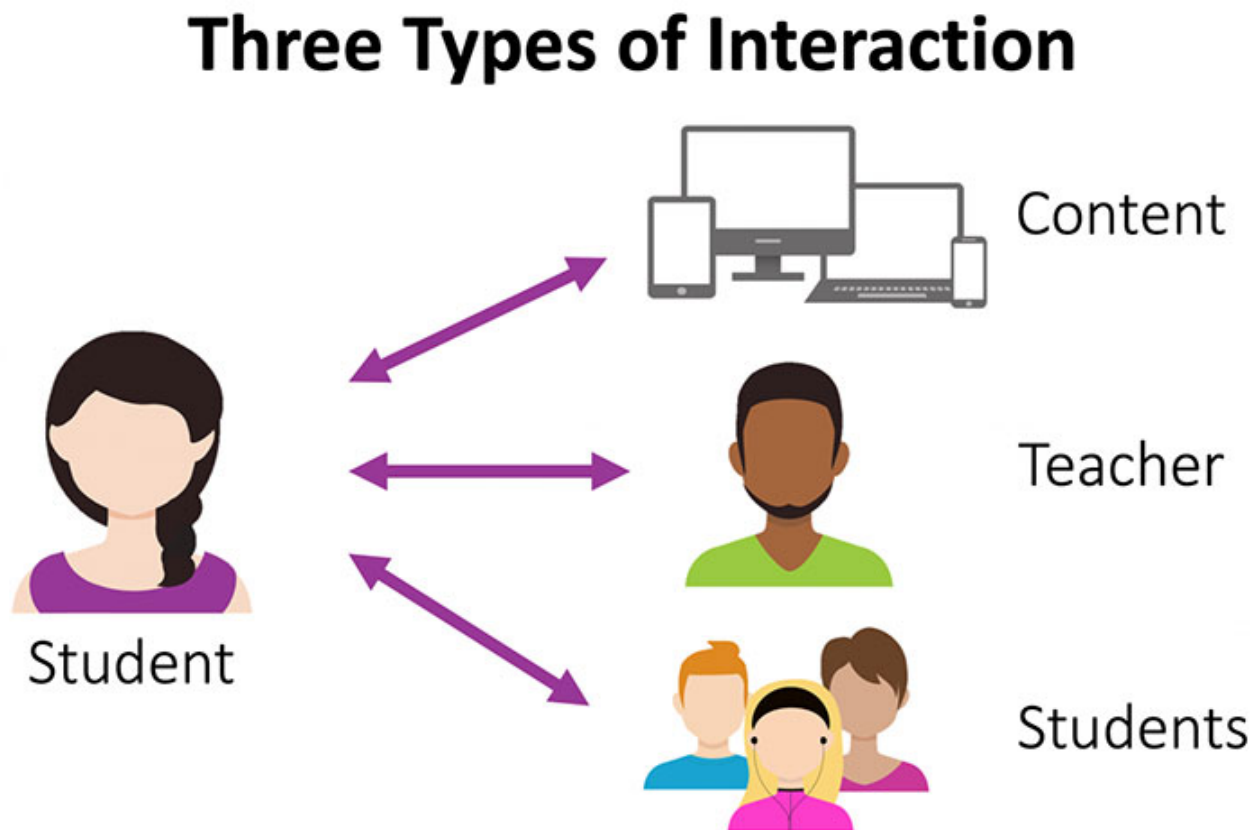


Figure 1. Three types of interactions in online learning (Jered Borup, from [K-12 Blended Teaching, CC BY 2.0](#))

How can asynchronous video assist online courses? By improving how students interact with the learning content (through viewing content, instead of just reading it), improving how they interact with each other (through discussions, collaborations, and informal talk), and improving how they interact with their instructors (through question-and-answer activities and advising). Asynchronous video is not the only means to do these things, but it can be an effective way to add needed variety to the monotony of text-based discussions and videoconferencing fatigue, while still honoring the flexibility that has made online learning appealing.

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Notes

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Using Educational Data Mining to Identify and Analyze Student Learning Strategies in an Online Flipped Classroom

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Instructional Design

Learning Analytics

Education

Online

Learning

Analyzing the learning analytics from a course provides insights that can impact instructional design decisions. This study used educational data mining techniques, specifically a longitudinal k-means cluster analysis, to identify the strategies students used when completing the online portion of an online flipped spreadsheet course. An analysis of these results showed that students did tend to follow a specific learning strategy as they completed this course. However, students also self-regulated to some degree, based on the topic and context of specific lessons. These insights not only improve our understanding about the students taking the course, but they also provide guidance for how the instructional design of the course might be improved. Of note is the practical value of this proof-of-concept study in using educational data mining to improve the instructional design of a course.

1. Introduction

Our ability to create quality online instruction has improved greatly in the past decade. Technology improvements, and our understanding of how to create online learning opportunities, have facilitated these improvements. Moreover, for a variety of reasons, students often prefer to take online, blended, or flipped classes that are facilitated by technology [1]. Still, there is much to understand about how students go about learning in an online setting and how we can use data analytics to improve this type of instruction.

One of the advantages of using online instruction is the ability to track students' activity within the course. Educational data mining capabilities built into many online courses enable learning analytics [2,3]. Basic data analytics capture assessment data and are used to inform teachers and students about an individual's progress towards accomplishing the intended learning objectives of the course. However, carefully crafted data mining efforts can also enhance our

understanding of the course in terms of what students are doing, how we might best provide feedback, and where we might make improvements in the design of our instruction.

This research used the learning analytic capabilities of an online flipped spreadsheet course to identify the strategies students used when completing the online portion of the course. This was then used to better understand where the instruction was functioning well and how the course might be improved. The study is not intended to be a generalizable case for all online courses, as differences in the students and contexts of each course will inevitably lead to different results. However, these insights not only improve our understanding about the students taking this course, but they also provide guidance for how the instructional design of the course might be improved. The study, in this sense, provides a proof-of-concept case study for using educational data mining in order to improve a course. The purpose of this study is to demonstrate, through an authentic case, how information can be data mined in an unobtrusive manner from a learning management system, how these data can be used to better understand the ways in which students go about utilizing course resources, and how this understanding might then be used to inform instructional design improvement when needed.

Previous Work

The research exploring the ways in which students go about learning makes a distinction between a learning approach and a learning strategy. Learning approaches are typically described as either "deep learning" or "surface learning" approaches [4]. Educators and researchers typically praise the virtues of deep learning and devise ways to encourage surface learners to engage more fully in the learning activities provided in order to learn all they can. Unfortunately, students do not always have the academic goals that their instructors might expect. Sometimes, they only intend to attain a sufficient level of learning to earn the grade they want [5]. A criticism of many courses is that they are designed in such a way that deep learning is not rewarded and, in fact, not needed for students to pass a course. Students can often achieve their learning goals with surface learning alone [6]. Through a meta-cognitive process, students devise learning strategies to accomplish their learning goals. These learning strategies may be intended to achieve either surface or deep learning. The strategies students develop are often exposed by the interaction they have with the learning resources made available to them.

A related construct essential to developing learning strategies is that of self-regulation. Self-regulation involves the ability to manage and monitor one's behavior [7,8]. Without the ability to self-regulate, students would not be able to modify their learning strategies. However, the ability to self-regulate one's actions and behaviors does not mean they will; self-regulation is often ancillary to other affective traits and influences [5,7,8].

The learning strategies that students devise are based on personal factors, including a student's academic goals, learning preferences, their self-efficacy and locus of control, as well as their abilities for self-regulation [9,10]. Contextual factors that affect the learning strategies student choose include the difficulty of the task, the student's interest in the topic, as well as the affordances that the instructional design of the course provides to the students [11]. The strategies student use to accomplish instructional activities and learning tasks often reflect a student's desire to learn efficiently, but not always effectively [12]. There are many reasons for this, one reason being that students often have conflicting intentions—they have many courses to study at school and a limited time in which to do them [5]. Often students will modify or completely change their learning strategies as the course progresses. The way a student approaches a learning situation is not inherent, rather, it is developed by the learner and is often dependent on the learning context and situational demands of the course [4]. Understanding the strategies students use to complete courses can help educators and instructional designers improve their courses and may provide actionable information that informs how, and in what ways, an educator might remediate learning gaps and students' misconceptions [13]. In the past, research involving learning strategies has relied primarily on self-report instruments [14]. Self-report, as a data collection method, is notoriously unreliable and constitutes an obtrusive form of data collection. In previous studies, detailed records of the topic focus, media choice, and study times and durations, were difficult to collect. For example, understanding the strategies students use to complete an assignment might require students reporting the time they spent on each problem, where and when students referenced their textbooks, and how students progressed from their initial answers to their submitted answers. These data have been difficult to collect in reliable efficient ways. This is where educational data mining (EDM) comes into play [1].

EDM is a relatively new term applied to the developing methods educational researchers use to explore the increasingly large-scale data that come from various educational settings, primarily online learning situations. EDM uses a variety of methods to better understand students and the settings in which they learn [15]. Particular to this study is the use of longitudinal k-means cluster analysis to better understand students taking a particular online course.

With advances in technology, and increases in technology-enabled instruction, researchers are able to gather considerably more information about the activities students engage in to complete the learning activities required for a course [1,15]. Capturing data within the system allows researchers to analyze the temporal order of the spontaneous individual activities of the students as they complete a course [16]. While this is an imperfect indication of the intents and actions of learners, it can allow researchers to obtain a more accurate description of the students' learning strategies, which can provide the basis for the real-time implementation of adaptive practices.

2. Methods

The setting for this study was an Introduction to Information Systems course. This online course provided the context for the authentic case being studied. The course covered both spreadsheet and database topics, but this study focused on the spreadsheet portion of the course only. The students in this course are typically undergraduate business students and are required to take the class. The class consists of both lecture and asynchronous computer lab sessions following a flipped classroom approach. Students complete assignments (i.e., the computer lab portion of the course) on a website provided by MyEducator, the publisher of the e-text used in the course. The website hosts the textbook and video instruction, as well as the graded assignments. During the lecture portion of the course, instructors review specific tasks and answer questions students may have. However, this particular study focuses on the online portion of the course only. All of the students have basic computing skills (Internet, word processing, and email). Although the course does not require students to have prior experience with Microsoft Excel, the students enter with a variety of spreadsheet skills. Students can move through the labs at their own pace, but the class session and online exams are scheduled.

Most of the instruction for the course is provided online via the MyEducator platform. The website includes a reader that presents the material to be learned, similar to a normal introductory textbook, with chapters and sections, key terms, and a glossary. Students read the textbook on their laptops and mobile devices, or they can listen to the text similar to the way they would listen to a podcast. Learning tools, such as flashcards for key terms, are also available. Each section of the text includes one or more video presentations. The videos are embedded within each web page alongside the text. This was designed to make access to both equally easy and, on the basis of previous evaluations and student comments, this seems to be the case (authors, 2013). The video content complements the text: students can choose to read, to watch video, or to do both. The videos have to be clicked by the student to be played. The data analytics built into the system creates a log of each student's activity as they proceed through the course.

2.1. Participants and Data Collection

This study used educational data mining techniques to analyze extant data gathered from students who completed the MyEducator spreadsheet course. Students taking the course were enrolled in multiple sections of the course at several universities. A total of 997 students were included in this analysis. Only those students who completed all the lessons and assignments required in the course were included in this study. The decision to exclude non-completers was deemed necessary, as the longitudinal aspect of the cluster analysis required a full set of data for each student. Most of the non-completers withdrew from the course prior to completing the second lesson. The remainder withdrew prior to completing the fourth lesson. As these data sets were incomplete, they could not be used for this particular analysis. Data were collected on the student actions taken in the online textbook reader and video player, as well as the actions taken within the Excel workbooks as students completed assignments. All the data used for the study were obtained with student approval, and were only used once the course was completed, following the studies of the Institutional Review Board approved protocols. None of the participants refused to have their data used. The system captured student behavior in four categories: reading, video watching, assignment access, and task guide views (see Table 1). In addition, the system recorded the order in which students completed various activities and the overlap in which they were completed. The grades that the students achieved on each assignment were also captured.

Table 1. Variables used in the k-means cluster analysis.

Variables	Code	Description
Reading	v	% of instructional text reading completed
Video	r	% of instructional videos watched
Assignments	a	how often students accessed assignments
Task Guide	t	number of times task guide was viewed (task by task)
Task Instructions	T	number of times task instructions were viewed
Order		order in which students completed instruction and assignments
Overlap		degree to which students moved between activities and task guides

Student reading was tracked by client-side scripts that updated the server every 15 s and during page unload. As students use the textbook reader, they scroll the browser window downward through the text. Whenever scrolling pauses long enough, the paragraphs in view are deemed read by the student. Although we cannot determine how carefully a student might have considered the material, the student viewing the text was assumed to be an indication that they read the material to some degree. Embedded videos were split into 5-s blocks and tracked by block. As students played a portion of the video using the inline player, the blocks that played were recorded as watched. Determining the quality of the reading or viewing is always beyond the ability of any research; however, this variable is an indication of quantity, not necessarily quality, on the part of the student.

In each lesson, a student begins an assignment by downloading an Excel workbook from the MyEducator website. Using Visual Basic for Applications (VBA), the programming language built into Excel, the workbook logs the student's progress as he or she completes the assignment and interacts with the MyEducator servers during submission. The data logs for each student tracks the cell inputs and actions as students work through each problem.

The students are presented with the worksheets necessary to complete the assignment, as well as a set of tools to manage both the completion and the submission of the assignment. Detailed instructions on assignment requirements are included in the workbook and can be opened as a local HTML file (the Instruction Sheet), or presented one step at a time, directly in Excel, within a floating window (the Task Guide). When students have completed their work, they use the Submit tool to have their work graded. While students are working through assignment requirements, the workbook records every change they make to a cell, as well as other activities, such as adding worksheets and creating charts. The workbook also keeps track of when it is opened, each time the instruction sheet is shown, each time the task guide is advanced to show another task, and when the workbook is submitted (see [Figure 1](#) for examples). The data collected by this logging process provides a detailed history of how the student completes the course activities.

Figure 1. Assignment, task guide, and data log examples.

The screenshot displays a software interface with a window titled "Assignment Tasks". Inside, a green header bar reads "Boolean". Below this, a task instruction is shown: "1 Use the AND function with appropriate arguments in cell H11 to determine if there is a force out at third base. There is a force out at third base if "Runner on 1st" and "Runner on 2nd" are both "Yes". [9 points]".

Below the task instruction, there are two data log tables. The first table is titled "show task" and has three columns: "#", "Time", and "Task".

#	Time	Task
18	10/7/2017 10:19:18 AM	1.4 Fly ball complete
19	10/7/2017 10:19:22 AM	1.5 Not 2 outs

The second table is titled "range modification" and has seven columns: "#", "Time", "Worksheet", "Address", "Formula", "Value", and "Step #".

#	Time	Worksheet	Address	Formula	Value	Step #
20	10/7/2017 10:19:45 AM	Boolean Functions	J11	=NOT(G11=2)	TRUE	1
21	10/7/2017 10:19:56 AM	Boolean Functions	J12:J40	=NOT(G12=2)	TRUE	1

2.2. Data Analysis

For a variety of reasons, technology-enabled online education has increased dramatically in the past decade [17,18]. Among the many benefits of technology-enabled instruction includes the increased amount of data available to educators and researchers. [19] describe the situation as drowning in a digital ocean of data. Certainly, the expectation that educators use data in order to enable educational discussion is not new see [20,21]. However, because of the increased amount of data now available, there is an increased need to make sense of these data and, as a result, the fields of learning analytic knowledge (LAK) and educational data mining (EDM) have gained prominence. We simply do not know what data is valuable, how best to manage it, and what to do with the information derived from these data [22]. EDM, in particular, uses a variety of methods to better understand students and the settings in which they learn. Particular to this study is the use of longitudinal k-means cluster analysis to better understand students taking a particular online course ($k = 4$ with 10 iterations). Data mining involves sense making [1]. One method for identifying patterns in the data is that of cluster analysis. While a detailed explanation of how cluster analysis works is beyond the scope of this paper, suffice it to say that this study used a longitudinal k-means cluster analysis to identify the optimal groupings that represented the most common strategy patterns used by students to complete each of the ten spreadsheet lessons in this course. The computation was based on data mined from the activity logs. Data were organized, scaled, and normalized to identify which activities were undertaken and how often (i.e., the magnitude and order in which students engaged in specific activities). Table 1 presents the variables used to complete the cluster analysis.

Cluster groupings were analyzed longitudinally by lesson, meaning each student was assigned a strategy group for each lesson. The students' learning strategies for each lesson were compared to identify changes (i.e., variations) made by students in their learning strategies. While the cluster analysis identified three basic groups, some students tended to self-regulate from lesson to lesson. A student's main strategy group was determined based on the strategy group a student followed most often (i.e., 50% of the time or more). Those who followed two strategies equally, or did not follow any strategy consistently, were not assigned a main strategy grouping. Group descriptive statistics were analyzed to help label each group's characteristics.

2.3. Learning Strategy Patterns

While the cluster analysis provides the cluster grouping based on the variables provided, researchers must still make sense of the grouping mathematically obtained. In order to do this, a student activity pattern was created for each student using a string of activity action codes. This was done in order to provide a human-friendly view into student strategies and allow researchers to visually inspect student strategies. Each letter represents the completion of about 10% of the different learning activities, although students may have completed activities such as accessing the assignments repetitively. The degree to which students accessed the assignments is indicated in the assignment variable, while the pattern only indicates when students completed at least 10% of the assignment. [Table 2](#) presents an example of one student's activity pattern. Note that each assignment provides a task guide for each part of the assignment, as well as the option to view all the task instructions at once. Students could view the task guides individually (represented by the letter t) or, optionally, they could view all the task instructions at once (represented by the capital letter T). The pattern is slightly different from the task guide and instruction variables used in the cluster analysis in that those variables represent how often the task guide and instructions were accessed, whereas the activity pattern depicts how much of the instructions were viewed. In the example presented in [Table 2](#), the student viewed all the task guides (not always the case) but did not use the task instructions option (which shows the entire task guide at once). This student may have viewed the task guide more than once, which is captured in the cluster analysis variables. The pattern codes were created for the researchers to better understand and interpret the student's learning strategy.

Table 2. Activity code example for an individual student: rrrrvvrrtttaataataata.

Code	Description
rrrr	started by reading 40% of the lesson text
vvv	watched 30% of the video blocks in that lesson
rr	read another 20% of the chapter text
ttt	viewed 30% of the task guides in the lesson assignment
aa	worked on 20%+ of the primary assignment
tataataata	continued by alternating between task guide and assignment

3. Results

The optimized cluster analysis results identified three learning strategy groupings. [Table 3](#) presents a description of these groups (including pattern examples) and the proportion of students who follow each of the strategies a majority of the time. Most students (58%) taking this course followed what we have labeled a Knowledgeable Confident strategy. These students completed less than 50% of the reading and viewed little of the video instruction (less than 4%). Primarily, they worked on the assignments quickly and, on average, achieved high scores. A second group (21%) we labeled Novice Careful. These students completed much of the reading (63%, more so in the earlier lessons), viewed a moderate amount of the video (29%, especially in later lessons), and tended to access the assignments more, with a higher number showing task use and task assignment overlap. The students in this group were either unfamiliar with the topic or, perhaps, were simply being careful or diligent. The last group we labeled Confident Traditional. Only 14% of students followed this strategy a majority of the time. These students completed a moderate amount of the reading (52%), only watched about 10% of the video content, and tended to complete assignments with little task guide use or overlap. The last group (7% of students) did not follow any one strategy to any great extent or switched equally between two strategy groups. Achievement by group and lesson is presented in [Table 4](#). Overall, there was little difference in

achievement between groups or lessons. While the difference in means were statistically significant [$F(3,9147) = 32.26, p < 0.001, \eta^2 = 0.007$], the group averages were less than two points apart, and the practical significance was negligible (less than 1% of the variance was explained by the students' main learning strategy).

Table 3. Learning strategy main grouping patterns.

Approach Strategy Description	Overall Proportion	Sample Activity Patterns
Novice Careful Higher reading (63%), more so in the earlier lessons. Moderate video use (29%), especially in later lessons. Higher showing task use and task assignment overlap.	21%	Rrrrrrvtttataartaattaata rrrrrrrTtaataataattaa
Confident Traditional Moderate reading (52%). Low video use (10%). Low task description use. Low task assignment overlap.	14%	Rrrttataataaaaa rrrrTataataaaaa
Knowledgeable Confident Lower reading (41%). Low video use (4%). Higher show task use and task assignment overlap.	58%	Rrtataaataataa rtataaaaaaa
No Main Group Followed a particular strategy less than 50% of the time.	7%	

Table 4. Strategy group average scores by lesson.

Learning Strategy Group	Lesson										Average
	1	2	3	4	5	6	7	8	9	10	
Novice Careful	96	97	94	97	99	92	89	98	97	97	96
Confident Traditional	95	95	94	97	98	90	90	97	96	97	95
Knowledgeable Confident	96	97	98	99	99	92	93	98	98	98	97
No Main Group	96	97	96	98	98	89	90	99	98	99	96

3.1. Self-Regulated Patterns

There are several reasons that might explain why students switch learning strategies. The degree to which students tended to switch between strategies is presented in [Table 5](#). The overall strategy students tended to use by lesson is presented in [Table 6](#). Of note is that students tended to switch from their main strategy in Lessons 1 and 10, but stick to their main strategy in Lessons 2 through 9. In Lesson 1 (Excel Basics), most students used a Confident Traditional strategy (64%) before moving to a more stable main strategy. In Lesson 10 (optimization using Excel's Solver feature, arguably a more difficult lesson), 79% of students chose a Confident Traditional strategy, with most moving from the Knowledgeable Confident strategy. Other than in Lesson 1 and Lesson 5, those students in the Novice Careful group seemed to stick to their main strategy most consistently. Lesson 5 (Charts and Graphs) was arguably the easiest lesson. In this lesson, most students (78%) chose to follow the Knowledgeable Confident strategy, with many from the Novice Careful group changing strategies for this lesson.

Table 5. Percent of those with a main strategy who changed from main strategy group by lesson.

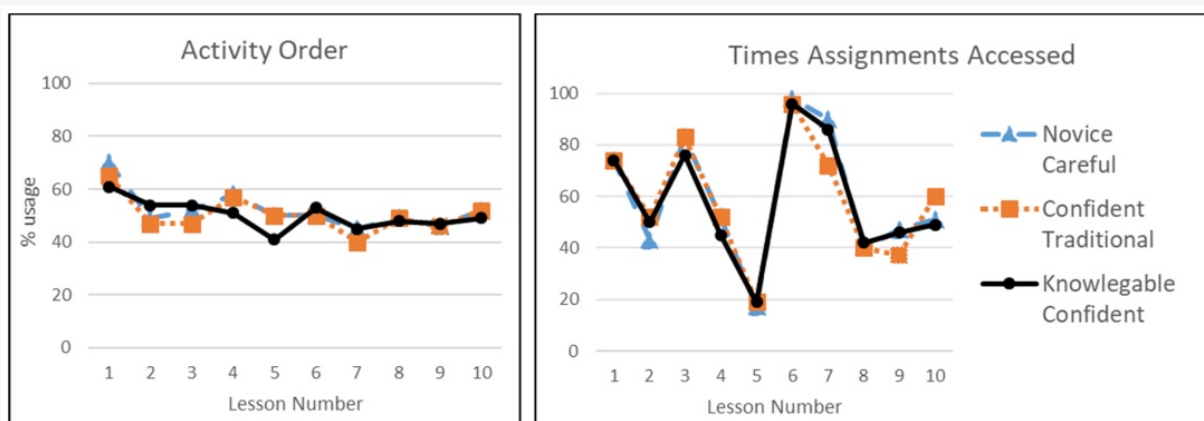
	Lesson										Avg. Overall % Who Changed
	1	2	3	4	5	6	7	8	9	10	
% who changed	56	17	19	12	24	25	17	17	15	71	27%

Table 6. Percent following a specific strategy by lesson.

	Lesson										% in Main Group
	1	2	3	4	5	6	7	8	9	10	
Novice Careful	8.6	24.0	27.4	26.4	5.6	35.7	29.4	23.6	20.7	20.7	21
Confident Traditional	64.0	17.5	13.4	15.1	16.4	20.4	17.0	16.9	15.9	78.7	14
Knowledgeable Confident	27.4	58.5	59.2	58.5	78.0	43.8	53.6	59.5	63.4	0.5	58

3.2. Common Strategies and Patterns

In some ways, the students in this study all followed a common pattern of learning (see [Figure 2](#). Regardless of the main strategy group students were inclined to follow, they tended to do the reading and view the video first (if they did these activities at all), prior to attempting the assignment. Very few went back to the reading and videos once they started the assignments. Likewise, how often students accessed the assignments was more a function of the lesson than the strategy students tended to follow. Lessons 6 and 7 (Beginning and Advanced Modeling) were the lessons where students accessed the assignment most often. Overall, students tended to get lower scores on these two lessons. Lesson 5 (Charts and Graphs) was a lesson where students tended to complete the assignment quickly without needing to go back to the assignment multiple times. Students tended to get near perfect scores on this lesson.

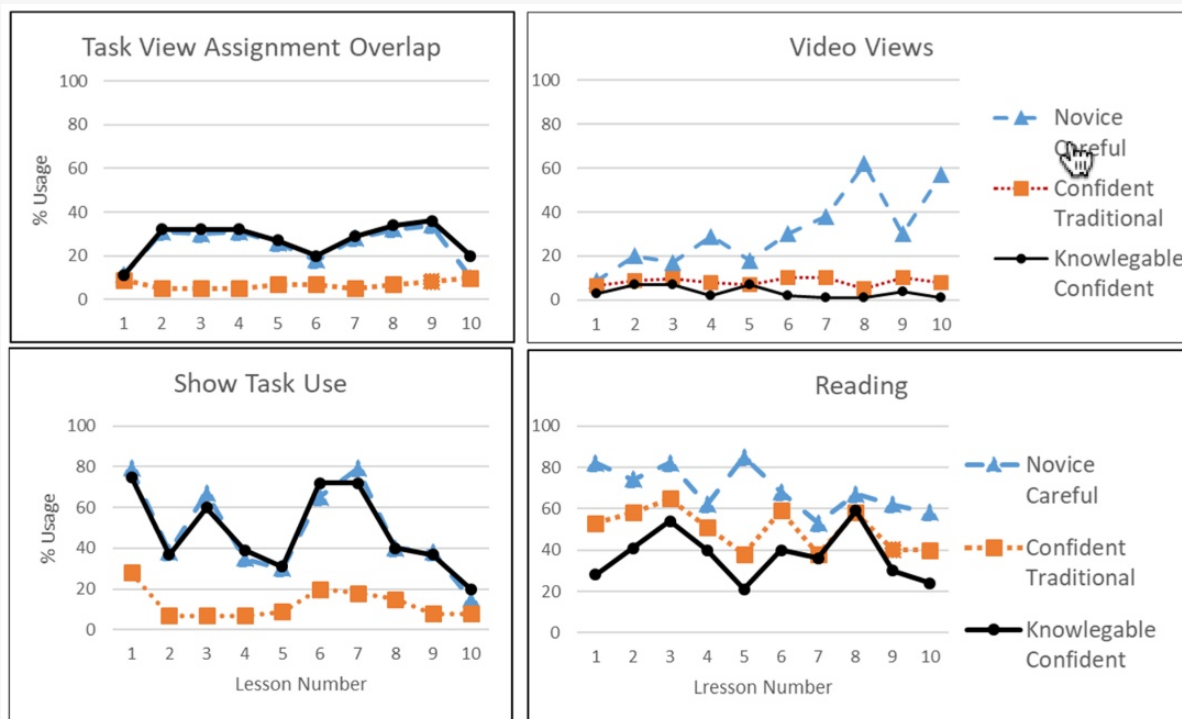
Figure 2. Activity order and times assignment was accessed by each strategy group.

3.3. Unique Strategies and Patterns

In several ways, students in this study followed a unique pattern of learning (see [Figure 3](#). While the Novice Careful and Knowledgeably Confident groups used the task view and overlapped the task view and assignments often, the Confident Traditional strategy groups tended to view the task instructions and use the task guide less often with less overlap. With

regard to reading, the Confident Traditional and Knowledgeably Confident strategy groups tended to read about half, or less than half, of the readings, depending on the lesson (with the exception of Lessons 3 and 8, where these students tended to do more of the reading on average). Those following a Novice Careful strategy tended to do most of the reading in the first part of the course, and then less of the reading in later lessons. Their video views, however, increased in later lessons. This was especially true for Lessons 8 and 10, arguably two of the more difficult lessons, based on instructor comments. Those following the Confident Traditional and Knowledgeably Confident strategies rarely viewed any of the video.

Figure 3. Unique activity patterns based on cluster grouping for each lesson.



4. Discussion and Conclusions

The purpose for conducting this study was to demonstrate the potential use of EDM techniques to better understand student behavior and identify the ways in which the instructional design of a particular course might be improved [15]. On the basis of the average student achievement results alone, one might conclude that the course needs no improvement. This particular course was a fairly easy introductory course. The average scores obtained by the students were quite high; still, some students struggled. Our analysis identified a group of students who may have struggled in specific ways. This suggests that improving the instructional design for some lessons might benefit this group of less-than-adept students, even though, on average, the performance of these students was adequate overall. In addition to this, we were also better able to understand student behavior in general [15] on the basis of the learning strategies they incorporated while taking this course.

On the basis of a longitudinal analysis of student behavior, and somewhat as expected [2,7,8,9], students did tend to follow specific learning strategies as they completed this course. In this course, the majority of students (58%) followed what we called a Knowledgeable Confident strategy. They watched very few videos and read less than half of the instructional text provided in the course. They tended to get right to the assignments and any extra effort, in terms of accessing the assignment and task guides, seemed to be a function of the lesson difficulty. Another common strategy, followed by 21% of students in this course, was the Novice Careful strategy. These students read considerably more of the text, and viewed much more of the videos, especially those provided in the later lessons where they spent less time reading and more time watching. However, students do seem to self-regulate.

About 23% of the time, students switched strategies for a specific lesson. For this course, students tended to switch the most at the beginning and end of the course. In Lesson 1, about 56% of the students deviated from their main strategy.

At this stage of the course, students may be making decisions about how much effort they will need to exert in order to satisfactorily complete the course and achieve their learning goals. They may also be assessing the degree to which instructional resources will help them accomplish their learning goals. After the first lesson, students seem to settle into a specific learning strategy. The lesson topic also seems to be a factor where students self-regulate. For example, in Lesson 5 (Charts and Graphs), students tended to move to a Knowledgeable Confident strategy, likely due to how easy the lesson was or, perhaps, based on the possibility that many students had previous experience with this topic. However, in Lesson 10 of this course, a large majority of students from the Knowledgeable Confident group abandoned their main strategy for completing lessons. One explanation for this might be that Lesson 10 (using Excel's solver) was something these students were unfamiliar with and they needed more assistance in completing the task. Analysis of these data help instructional designers focus their efforts. It is true that a mixed methods approach may be needed in order to fully understand how to improve a course. However, using learning analytics not only helped identify how students went about completing their learning, but also helped us identify where, and in what ways, the instruction might be improved. For example, anecdotal self-report evidence, based on student comments, suggests that the videos were a well-used and well-received element of this course. The students gave positive ratings with regard to the convenience of watching the videos on demand, and to the fact that they could pause and rewind the videos, and even watch them at an increased speed. This perception did not mirror the empirical usage patterns we observed. There may be several ways to interpret this information. One conclusion might be that the materials need to be changed. Certainly, on the basis of an analysis of the learning analytics for this course, the video portion of the course likely needs to be evaluated. Given the high video usage of some students, the video components for more challenging lessons may need to be revised or improved. Still, many students do not seem to utilize video resources (an important finding on its own). However, improving these components may lead to greater use and more efficient learning, especially for those lessons found to be more challenging [1,15]. For example, many students seem to need, or could benefit from, enhancing the video resources in the later lessons. Given that many students struggle with specific lessons, these could be the focus of instructional design efforts. More study is needed for this aspect of the course.

Author Contributions

Conceptualization, R.D., G.A., C.A., N.B. (Nesrin Bakir) and N.B. (Nick Ball); Data curation, G.A. and N.B. (Nesrin Bakir); Formal analysis, R.D., G.A. and C.A.; Investigation, R.D., G.A., C.A., N.B. (Nesrin Bakir) and N.B. (Nick Ball); Methodology, G.A., C.A. and N.B. (Nick Ball); Project administration, R.D.; Resources, N.B. (Nick Ball); Writing—original draft, R.D.; Writing—review & editing, G.A. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

The study was conducted according to the guidelines of the Institutional Review Board (IRB) at Brigham Young University which concluded that the study did not require formal IRB approval as it used existing data with all identifying information removed. No additional data was collected from human subjects.

Informed Consent Statement

Even though this study did not require an IRB research protocol approval, informed consent was obtained from all subjects involved in the study. As student begin this online course, each was asked permission to have their data analytics used for research purposes. All data utilized in this study was used with the permission of each individual student.

Data Availability Statement

Data supporting reported results can be obtained from the principle investigators of this study by request.

Conflicts of Interest

The authors declare no conflict of interest.

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Instructional Design

Continuous Improvement of Instructional Materials
The Design of Holistic Learning Environments
Designing Technology-Enhanced Learning Experiences
Educational Technology
"I Can Do Things Because I Feel Valuable"
Implementation and Instructional Design
Instructional Design Prototyping Strategies
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Continuous Improvement of Instructional Materials

David Wiley, Ross Strader, & Robert Bodily

Continuous Improvement

Instructional Design Practice

Data Analytics

Online Teaching

Student Learning

Student success

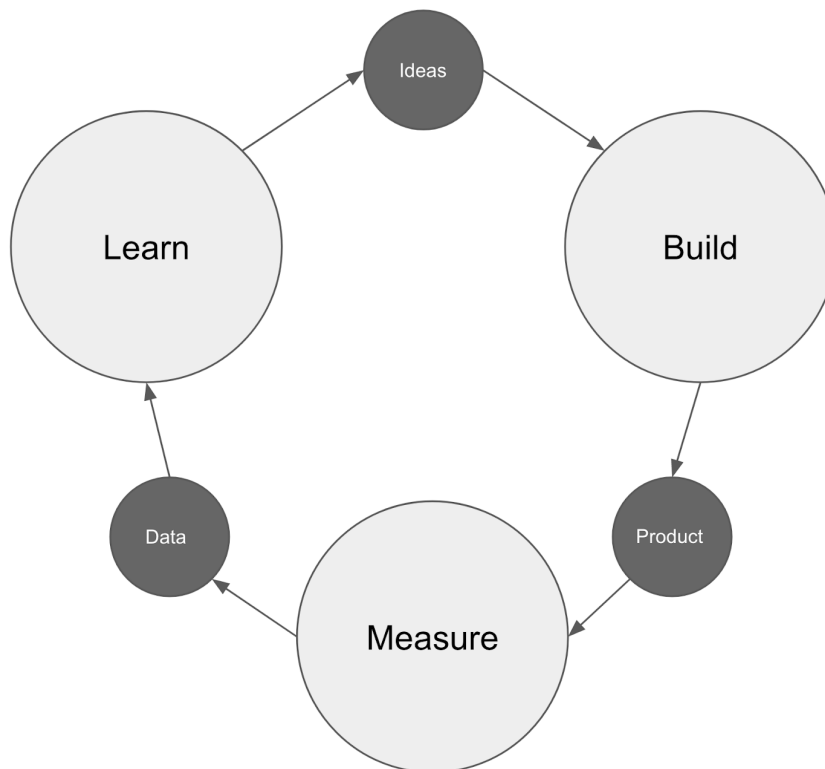
From time to time new technologies provide us with a qualitatively different ability to engage in previously possible activities. For example, 20 years ago it was already possible to publish an essay online. You simply used the command line program Telnet to login to a remote server, navigated into the directory from which your webserver made html files available to the public, launched the pico editor from the command line, wrote your essay, and manually added all the necessary html tags. Today, open source blogging software like Wordpress makes publishing an essay online as easy as using a word processor. Yes, it was possible to publish essays online before, but the modern experience is qualitatively different.

“Evaluate” is the final step in the traditional ADDIE meta-model of instructional design, and it has always been possible—if, at times, expensive and difficult—to evaluate the effectiveness of instructional materials. Modern technology has made the process of measuring the effectiveness of instructional materials a qualitatively different experience. Gathering data in the online context is orders of magnitude less expensive than gathering data in classrooms, and open source analysis tools have greatly simplified the process of analyzing these data.

Historically, any needed improvements discovered during the evaluation process would take a significant amount of time to reach learners, as they could only be accessed once new editions of a book were printed or new DVDs were pressed. Again, modern technology makes the delivery of improvements a qualitatively different exercise. When instructional materials are delivered online, instructional designers can engage in [continuous delivery](#) practices, where improvements are made available to learners immediately, as often as multiple times per day.

The modern approach to continuous improvement designed for use in the context of online services described by Ries (2011), called the “build - measure - learn cycle,” is illustrated in Figure 1.

Figure 1



In this chapter we adapt the build - measure - learn cycle for use by instructional designers who want to engage in continuous improvement. Because our focus is on the improvement of instructional materials, our discussion below does not include a discussion of the creation of the first version of the materials. (The first version of the materials could be open educational resources created by someone else or a first version that you created previously.)

The chapter will proceed as follows:

- **Conceptual Framework:** We argue that all instructional materials are hypotheses, or our best guesses, informed by research, about what instructional design approach will support student learning in a specific context. Thinking this way will naturally lead us to collect and analyze data to test the effectiveness of our instructional materials.
- **Build:** We describe the implications of designing for data collection, together with the instrumentation and tooling that must be built in order to collect the data necessary for continuous improvement.
- **Measure:** We describe the process of analyzing data in order to identify portions of the instructional materials that are not effectively supporting student learning.
- **Learn:** We discuss methods to use when reviewing less effective portions of the instructional materials and deciding what improvements to make before beginning the cycle again.
- **Technical Note:** We briefly pause to discuss the role of copyright, licensing, and file formats in continuous improvement.
- **Worked Example:** We demonstrate one trip through the cycle with a worked example.
- **Conclusion:** We end with some thoughts about the imperative implied for instructional designers by the existence and relative ease of use of continuous improvement approaches like the build - measure - learn cycle.

Conceptual Framework

Instructional Materials Are Hypotheses

People who design instructional materials (who we will refer to as instructional designers throughout) make hundreds of decisions about how to best support student learning. Each decision is a hypothesis of the form “in the context of these learners and this topic, applying this instructional design approach in this manner will maximize students’ likelihood of learning.” The ways in which these individual decisions are interwoven together creates a network of hypotheses about how best to support student learning.

Hypotheses Need to Be Tested

It reveals a fatal lack of curiosity for an instructional designer to simply say “these materials were designed in accordance with current research on learning” without following through to measure their actual effectiveness with actual learners in the actual world. While designing instructional materials in accordance with research is a positive first step, to our minds the most important measure of the quality of instructional materials is the degree to which they actually support student learning. Questions of whether or not the materials are informed by research, are finished on schedule and on budget, are stunningly beautiful, render correctly on a mobile device, or were authored by a famous academic become meaningless if students who use the materials do not learn what the designers intended.

Initial Hypotheses Are Seldom Correct

Hypotheses need to be refined in an ongoing cycle of improvement. Data collected during student use of content and from assessments of learning can be used to identify specific portions of the instructional materials (i.e., specific instructional design hypotheses) that are not successfully supporting student learning. Once these underperforming designs (hypotheses) are identified, they can be redesigned, improved, and incorporated into a new version of the instructional materials. The updated collection of instructional design hypotheses can then be deployed for student use, and the cycle of continuous improvement can begin again.

Build: Designing for Data, Instrumentation, and Tools for Data Collection

In order to be able to engage in continuous improvement, instructional materials must be designed for data collection. There must be a unifying design framework that will allow data from a wide range of sources to be aggregated meaningfully. The method we will describe throughout this chapter organizes instructional materials around a network of learning outcomes. In this method of designing for data collection, all instructional materials (e.g., readings, simulations, videos, practice opportunities) are aligned with one or more learning outcomes. All forms of assessment, both formative or summative, are also aligned with one or more learning outcomes (this alignment must be done at the individual assessment item level.)

Once instructional materials have been designed for data collection, tools and instrumentation must be created so that the data can actually be collected and managed. The system that mediates student use of the instructional materials (e.g., a learning management system) must be capable of (a) expressing the relationships between learning outcomes, instructional materials, and assessments, (b) capturing data about student engagement with these instructional materials, and (c) capturing item-level data about student engagement with, and performance on, assessments. The data collected by the system should be able to answer questions such as, for any given learning outcome, what instructional materials in the system are aligned with that outcome? (If instructional activities are “aligned with” a learning outcome, student engagement with the instructional activities should support mastery of the outcome.) For any given learning outcome, what assessment items in the system are aligned with that outcome? (If assessments are “aligned with” a learning outcome, student success on these assessments should provide evidence that they have mastered the outcome).

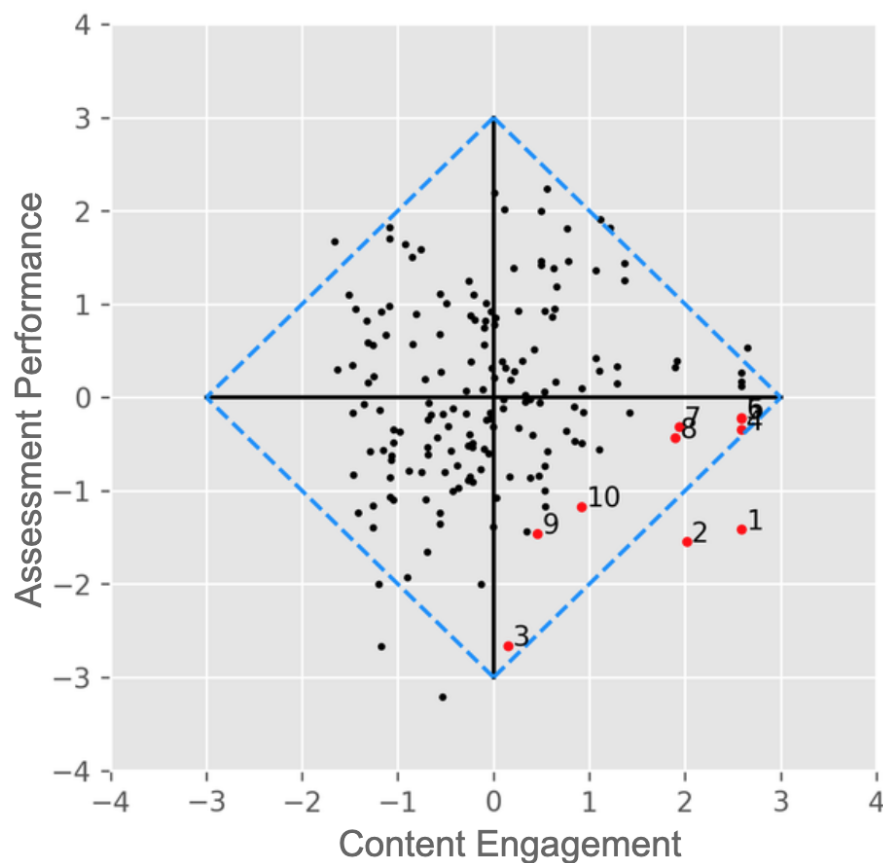
Measure: Using RISE Analysis to Identify Less Effective Learning Materials

As described in Bodily, Nyland, and Wiley (2017), activity engagement data and assessment performance data can be analyzed together to identify learning outcomes whose aligned instructional materials are not sufficiently supporting student mastery (as demonstrated by performance on aligned assessments). The purpose of Resource Inspection, Selection, and Enhancement (RISE) analysis is to identify learning outcomes where students were highly engaged with aligned instructional materials, but simultaneously performed poorly on aligned assessments.

Each point in Figure 2 represents a learning outcome. The x-axis is engagement with instructional materials and the y-axis is assessment performance, both converted to z-scores. The bottom-right quadrant (high engagement, low performance) indicates which outcomes should be targeted for improvement and are numbered to indicate the order in which they should be addressed.

Figure 2

A RISE Analysis Plot



An open source software implementation of RISE analysis is described in Wiley (2018). This greatly simplifies the process of running RISE analyses, as long as appropriate data on learning outcome names, content engagement, and assessment performance are available.

Learn: Understanding Why Learning Outcomes End up in the Bottom Right Quadrant

Once learning outcomes are identified as being in the bottom right quadrant of a RISE analysis plot, the cause of the problem can be isolated. For brevity, we will refer to learning outcomes in the bottom right quadrant of a RISE analysis plot as “underperforming learning outcomes” below. The root of the problem can generally be identified in two steps.

The first step in isolating the problem with an underperforming learning outcome is evaluating assessments aligned with each learning outcome. Are the assessments accurately measuring student learning? Questions to ask at this stage include: are there technical problems with the assessment? Are items miskeyed? Are other sources of spurious or construct-irrelevant difficulty present? Are measures of reliability, validity, or discrimination unacceptably low? If the answer to any of these questions is yes, improvements should be made to problematic assessments, after which the instructional designer can stop working on this learning outcome and move onto the next. There is likely no need to make improvements to instructional materials aligned with this learning outcome.

If the aligned assessments are functioning as intended, the instructional designer can move on to the second step—reviewing the instructional materials to determine why they aren’t sufficiently supporting student learning. This process is highly subjective and brings the full expertise of the instructional designer to bear. The instructional designer reviews the instructional materials aligned with the learning outcome and asks questions about why students might be struggling here. For example:

- Is there a mismatch between the type of information being taught and the instructional design approach originally selected? For example, if students are learning a classification task, are examples and non-examples provided without a specific discussion of the critical attributes that separate instances from non-instances?
- Is there a mismatch in Bloom’s Taxonomy level between the learning outcome, the instructional materials, and the assessment? (For example, are the learning outcome and instructional materials primarily the *Remember* level, while the assessments require students to *Apply*?)
- Have the instructional materials failed to provide learners with an opportunity to practice in a no/low-stakes setting and receive feedback on the current state of their understanding?

We cannot list every question an instructional designer might ask, but we hope these examples are illustrative. Talking with students can also be incredibly helpful at this stage. These conversations are an effective way for the instructional designer to zero in on root causes of students’ misunderstandings.

Once the instructional designer believes they have identified the problems (i.e., they have a new hypothesis about how to better support student learning), new or existing instructional materials and assessments can be created, adapted, or modified. Students can also be powerful partners and collaborators in creating improvements to the instructional materials (e.g., OER-enabled pedagogy as described by Wiley and Hilton (2018)).

When this (Build) process is completed, the new or improved materials can be released to students immediately. Once students are using the new version of the materials, this use will result in the creation of new data which the instructional designer can examine using RISE analysis (Measure). These analyses support the instructional designer in forming new hypotheses about why students aren’t succeeding (Learn). When this continuous improvement process is followed, instructional materials should become more effective at supporting student learning with each trip through the cycle.

Technical Note: The Role of Copyright and File Formats

Before adaptations or modifications can be made, instructional designers must have legal permission to make changes to the instructional materials. Because copyright prohibits the creation of derivative works that are often the result of the improvement of instructional materials, one of two conditions must hold. In the first condition, the instructional

designer (or their employer) must hold the copyright to the instructional materials, making the creation and distribution of improved versions legal. In the second condition, the instructional materials must be licensed under an open license (like a Creative Commons license) that grants the instructional designer permission to create derivative works (aka improved versions of the instructional materials).

Legal permission to create derivative works can be rendered ineffective if the instructional materials are not available in a technical format amenable to editing (e.g., HTML). ALMS analysis as described in Hilton, Wiley, Stein, and Johnson (2010) includes four factors to consider regarding the “improvability” of instructional materials. The first factor is *Access to editing tools*—is the software needed to make changes commonly available (e.g., MS Word) or obscure (e.g., Blender)? The second factor is the *Level of expertise required* to make changes—is the content easy to change (e.g., Powerpoint) or difficult to change (e.g., an interactive simulation written in Javascript)? The third factor is whether or not the instructional materials are *Meaningfully editable*—is the document a scanned image of handwritten notes (this text is not easily editable) or an HTML file (easily editable)? The final factor is *Source file access*—is the file format preferred for using the resource also the format preferred for editing the resource (e.g., an HTML file) or are the preferred formats preferred for using and editing the files different (e.g., PSD versus JPG)?

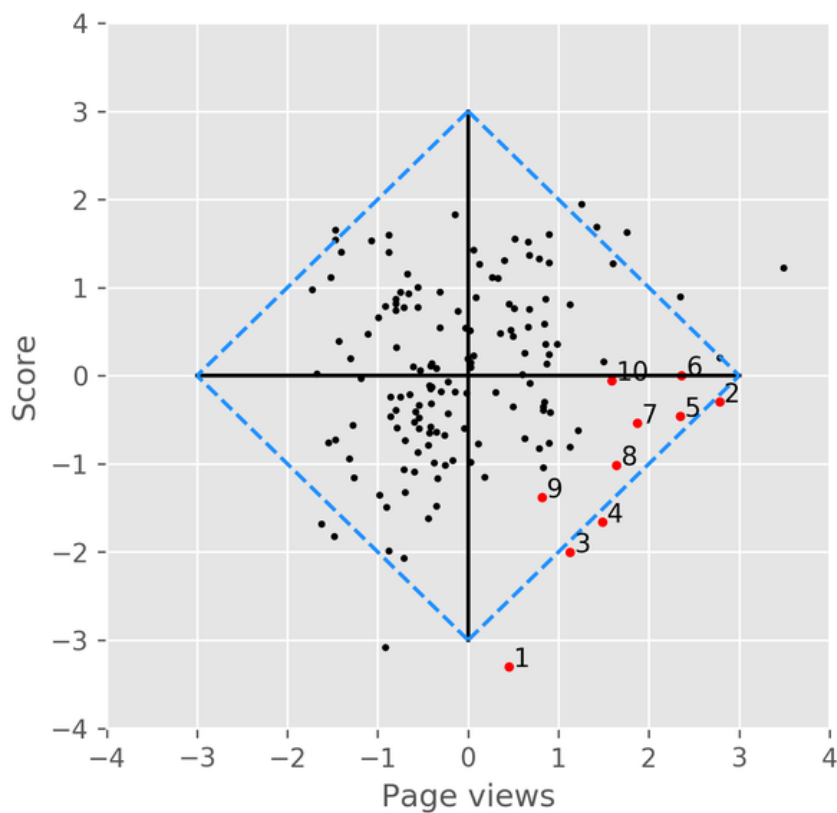
If the instructional materials you are working with do not belong to you or your employer, are not openly licensed, or are available only in file formats that are not conducive to adaptation and modification, you may not be able to engage in continuous improvement.

A Worked Example

Lumen Learning, a company that offers instructional materials for college classes that can be adopted in place of traditional textbooks, offers a Biology for Non-majors course in its Waymaker platform. This platform allows instructional designers to enter learning outcomes and align all instructional materials and assessment items with the learning outcomes. A [RISE analysis](#) was conducted using the content engagement data and assessment performance data for all students who took the Biology for Non-majors course during a semester. Among the top 10 underperforming learning outcomes it identified, the RISE analysis revealed that students were performing poorly on assessments aligned with the learning outcome “compare inductive reasoning with deductive reasoning” despite the fact that students were engaging with the aligned instructional materials at an above average rate (see outcome 1 in Figure 3 below). This learning outcome was selected for continuous improvement work.

Figure 3

Biology for Non-Majors RISE Analysis Plot



A review of the aligned assessment items by an instructional designer revealed that the items appeared to be keyed correctly and free from other problems. Following this review of the aligned assessments, the instructional designer reviewed the aligned instructional materials guided by the question, “why are students who use these instructional materials not mastering the outcome?” The analysis revealed that the instructional materials for this outcome were comprised of two paragraphs of text content, each of which defined one of the terms. No other instructional materials were provided in support of mastery of this learning outcome and students appeared to be unable to remember which of these similar sounding terms was which.

The instructional designer decided to make minor edits to the existing paragraphs to improve their clarity and also to create an online interactive practice activity (Koedinger et al., 2017) in support of this learning outcome. This activity provided students with mnemonic tools to help them remember which term is which, and combined these mnemonics with practice exercises in which students classify examples as either inductive or deductive and receive immediate, targeted feedback on their performance. The online interactive practice activity can be viewed in context at <https://edtechbooks.org/-QwUE>.

These new and updated instructional materials are now integrated into the existing materials and are being used by faculty and students across the United States. After another semester is over, the RISE analysis will be rerun. This new analysis will either confirm that the improvements to the instructional materials have improved student learning, in which case other underperforming learning outcomes will be selected for continuous improvement, or they will confirm that there is still work to do to better support student learning of this outcome.

Conclusion

Modern technologies, including the internet and open source software, have radically decreased the cost and difficulty of collecting and analyzing learning data. Where evaluation alone was once prohibitively difficult and expensive, today the entire continuous improvement process is within reach of those who design instructional materials for use in online

classes and other technology-mediated teaching and learning settings. While Ries (2011) described the build - measure - learn cycle as a way to rapidly increase a company's revenue, we see a clear analog in which similar approaches can be used to rapidly increase student learning. We now live in a world where it is completely reasonable to expect instructional materials to be more effective at supporting student learning each and every term.

We invite the reader to help us make this possible state of affairs the actual state of affairs by engaging in continuous improvement activities in their own instructional design practice. And in the spirit of continuous improvement, we further invite the reader to join us in developing and refining the processes described in this chapter—in part by completing the survey at the end of this chapter and providing us feedback on how the chapter can be improved.

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The Design of Holistic Learning Environments

Jason K. McDonald

Design

Instructional Design

Online Learning

UX Design

Experience

Learning

Learning Design

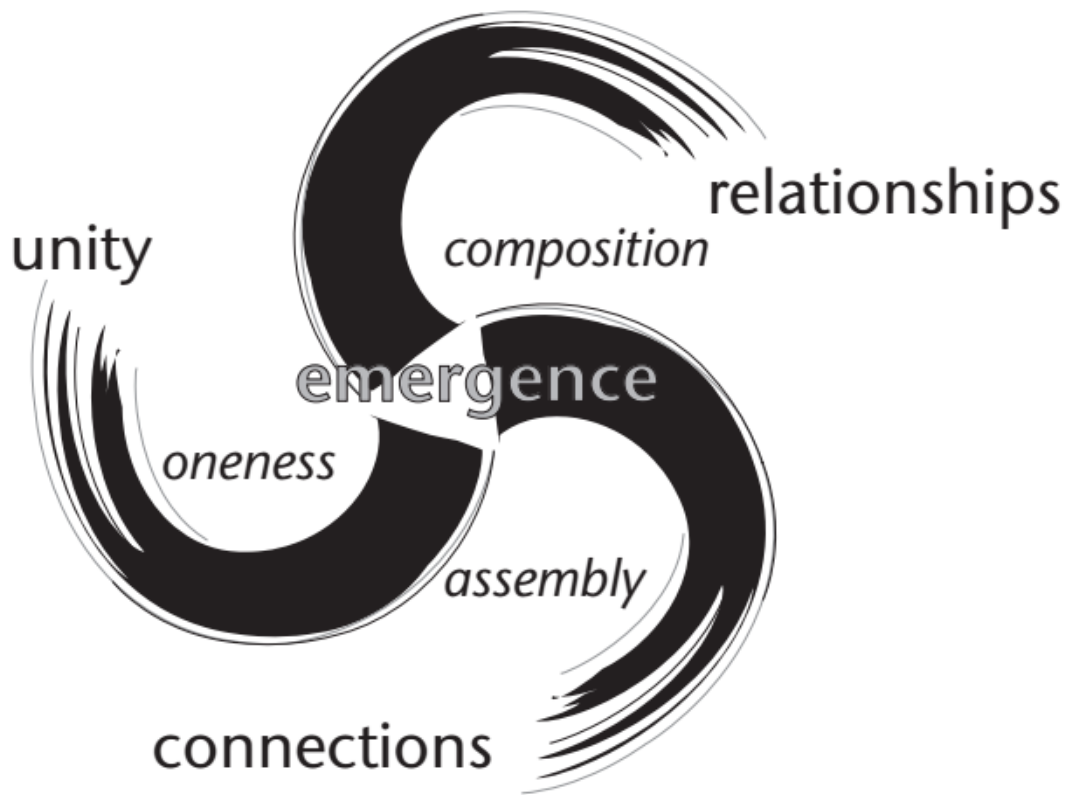
Universal Design for Learning

One of the factors that makes a design compelling is when it has a sense of harmony and completeness. When we experience the design, it does not feel like a collection of individual parts that just happen to be together. Instead, they “fit” together. In fact, we likely do not stop to consider the discrete components making up the design at all. But if we do notice the individual parts, we typically can sense how each belongs. There is a sense of balance and resonance that emerges from the precise configuration we experience. We see the design as a whole, meant to be experienced as a whole. And in the best cases, the sense of completeness and balance somehow extends into us—we feel more complete and more in balance because we have encountered something as complete and in balance as this design. Nelson and Stolterman (2012), in their book, *The Design Way: Intentional Change in an Unpredictable World*, call this type of experience holistic design. In this chapter, I consider some of the conditions that lead to holistic designs, along with what these conditions could mean in the context of instructional design.

Figure 1 presents a diagram from *The Design Way* that highlights the major conditions of holistic design. Discussion of the entire diagram is more complex than we need to consider here, but if you are interested in the topic, I encourage you to review Nelson and Stolterman’s complete treatment in their book (Nelson & Stolterman, 2012, pp. 93–102).

Figure 1

Dimensions of Emergent Wholes



Note. Reprinted from Nelson, H. G., & Stolterman, E. (2012). *The design way: Intentional change in an unpredictable world* (2nd ed.). The MIT Press, p. 94. Used by permission; all rights reserved.

The diagram illustrates how we can design objects or services in a way that transcends the individual parts from which they are assembled to create something holistic. As Nelson and Stolterman put it, we rely on “those unifying forces that cause things to stand together . . . thus forming meaning for individuals who are part of the whole or served by the whole” (p. 94). When something is holistic, it has properties that cannot be predicted when we examine each of the pieces individually. But that does not mean the individual parts are not important. Quite the opposite, in fact. Each component contributes something to the overall sense of the whole and is necessary to achieve the effect of the whole. Removing or changing the pieces, then, could lead to a design with a completely different effect.

Holism is not often addressed in instructional design. Perhaps the closest we come is when we consider the graphic design of our instruction. In this case we do frequently consider what effect the visual components of our instruction are having, and if they are contributing to an overall pleasing visual sense. (For tips on how to create a pleasing visual design, see the articles [The Building Blocks of Visual Design](#) or [10 Basic Principles of Graphic Design](#)). Holism is important to consider in other aspects of instruction as well. Yet despite its importance, holistic design can also be difficult to talk about explicitly. The effects it has are subtle. But using Nelson and Stolterman (2012) as our guide, let’s explore some ways that the instruction you design can inspire a sense of holistic completeness.

Connection

First, consider the effects of the connections between individual elements in your design. There is an analogy here to connections between physical objects: when joining together two pieces of wood, we connect them with a nail or a screw. When joining together pieces of metal, we connect them with a weld. We can also consider more sophisticated methods of connecting when we include the idea of an intermediary fastener. Nails and screws are a direct connector between two pieces of wood, and the result is a rigid link. But we could connect our wood using an intermediary: a

hinge. We screw the hinge into adjacent pieces of wood and the result is a connection between the wood that is more flexible. When building an object, then, we need to consider what materials we are working with, and this will help us decide what kinds of connections we can make. Then we consider what we want the connection between the elements to be, and this will help us further choose an appropriate link to achieve our objective. A holistic design will choose connections that are both appropriate for the material being used as well as the type of connection that is desired.

There are at least two applications of this analogy to instructional design. The first is between different elements of an instructional product that students experience. What types of connections are possible between the different pages of an online educational activity, for instance? Or between elements on the same page? Or between different units of the same course? The types of connections that are possible will be partly a function of the material the designer is working with (images, text, web pages, etc.), and partly a function of the effect the designer wants to have (the student can choose between these three pages; or the student must go to this page, etc.). Attentive designers will consider the connections between these elements as much as a carpenter will consider the connection between wood beams supporting the structure they are creating.

Another type of connection instructional designers can consider is between the different layers of their instruction. Gibbons (2013) proposed that all instructional products or learning systems are composed of different layers that perform different functions in a design. For example, one of the layers is the representations that students experience (what they see, hear, touch, etc.). Another layer is the controls that students use to input information back into the instruction (typing into a text box, submitting a form, or answering a teacher's question). There must be some kind of connection between these layers for the instruction to have its effect. If instructional designers pay attention to the effects they want each layer to have, they can find connections between the layers they can intentionally design to help lead to that effect. Similar to connections between individual elements, designers should both pay attention to the material each layer is made of (physical or conceptual) as well as the type of connections that are appropriate for the intended effect.

Application Exercise

Find an example of an instructional product or service (perhaps an online training module, a face-to-face classroom lesson, or a museum-type experience). Ask yourself:

- What are the individual elements of which the product is composed? (e.g. different pages in the module; different activities in the lesson)
- What is connecting those elements together?
- Why do you think they were connected in that way?
- Can you imagine alternative ways of connecting these elements?

Relationships

The second condition of holistic design is the relationships between elements in a design. Relationships are similar to the idea of connection, since every relationship connects different entities in some way. So everything just described about connections applies to relationships as well. But relationship implies more than the fact that elements are connected. The idea of relationship implies there is a structure to the connection, one that suggests an effect that transcends what the individual elements provide on their own. When two (or more) things are in relationship with each other, we can see that they belong together. Returning to our previous example of making something out of wood, we can easily nail together wood of any shape or size. But a relationship between different pieces of wood implies that we have done more. We also consider how our joint between the pieces fits together harmoniously. We might cut one board so it fits into an existing groove in the other. Or we apply stain or paint so the coloring of the wood produces a pleasing

effect when placed next to each other. We can also consider the relationship of what we build with something larger than itself. For instance, when we ask whether a chair fits in a room, we usually aren't talking about if we can actually squeeze it into the space. Rather, what we usually mean is does the chair feel like it belongs? Is the relationship between the chair and the rest of the furniture harmonious? Or does it feel like the chair came from a different family than everything else in the room?

Parrish (2005) described some ways that instructional designers can pay attention to the relationship between elements in their designs. He encouraged designers to pay attention to the "rhythms of instructional activities" in their products, to find "methods for creating dynamic tension and revealing unity within content sequences," or to develop "strategies that provide memorable closure to learning experiences" (p. 17). In each of these cases, elements in an instructional product would not only be connected in some way, but the structure of that connection would produce an aesthetic effect. This effect transcends the actual material being interacted with in a way that communicates messages that often cannot be spoken (e.g. why a subject matters, what is beautiful about it, or how might I [the student] be changed by it).

Application Exercise

Using the example you found earlier, try identifying the relationships between elements in the instruction. Ask:

- What are the structures of the connections identified in this instruction?
- What kind of effects do those relational structures suggest?
- Can you imagine alternative relationships that can connect these elements?

Unity

The last factor to consider is unity, or the overall effect the connections and relationships have in a complete design. In considering unity we should first recognize that there will always be connections and relationships between design elements. If designers do not consider them intentionally (leaving them to chance), people will look for some kind of connection, and there is no guarantee the designer will be happy with what they find. When designers do not intentionally plan for unity between connections/relationships, often this leads to the design being experienced as disjointed. People may not be able to identify what about it is dissatisfying, but they will sense something about it that is harsh or jarring. But worse is when the connections and relationships that people find generate a sense of dissonance or incongruity, an active sense that these elements do not belong together. And more than being slightly displeased with the design, people actively dislike it, again often without knowing exactly why.

But if connections and relationships are intentionally considered, they can generate an overall, unifying effect that is pleasing and pleasurable to experience. People feel comfortable with these types of design. Wilson (2013) described this as "how elements hang together" for the person experiencing it, "and support [them having] a coherent experience" (p. 40). The word coherent is the key. Unity is a result of everything in the design seeming to belong, to be in its proper place, and be in that place for a proper reason. Let's assume we designed and built a beautiful, ornate chair, with intricate patterns in the legs and a soft, luxurious fabric on the back and seat. If we place the chair in an elementary school cafeteria, it will stick out. Any sense of unity in the room (assuming there was one before!) would be lost. But if we place our chair in a university library, perhaps in a special collections reading room, it could contribute to a sense of unity that people experience in the room as being a place of learning.

How does unity apply in instructional design? Parrish (2009) described it as the designer's care for experiences that are "infused with meaning, and felt as coherent and complete" (p. 511). While there might be multiple ways to do this, Parrish proposed that designers can pursue unity by intentionally considering connections and relationships between

instructional elements that (a) create distinct beginnings, middles, and endings for the instruction; (b) set students in the role of being the protagonist of their own learning; (c) set a theme for the instruction through the choice of learning activities; and (d) create a context that immerses students in the instructional situation.

Application Exercise

Using the same example as before, consider the sense of unity you experience with the instruction. Ask:

- Do the connections and relationships in the instruction contribute towards an overall effect?
- How would you characterize this effect?
- Is there any evidence to suggest this effect was intentionally considered by designers? Or did they seem to leave it to chance?
- What might you change about the instruction to generate a stronger sense of unity?

Conclusion

Nelson and Stolterman (2012) concluded that a holistic design creates emergent qualities, or qualities that cannot be experienced when only considering the individual elements that are connected together in intentionally considered relationships of unity. They also stated these emergent qualities have “significance” for the people using a design. They mean something to people, and “embody [some] essence of human potential more fully” (p. 101). This seems to be sufficient justification for considering holistic design as part of the instructional design process. Instructional design is about helping people learn, or, in other words, unlocking some aspect of their human potential. And it is more than the educational content and instructional strategies that do this. To create designs that are truly remarkable and uncover at least some aspects of human potential, people need to experience instruction with emergent, holistic qualities. These are generated as designers consider the connections between individual elements of their instruction, form those connections into structured relationships, and align both into a unified whole that can produce an aesthetic, transcendent effect.

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At BYU, Dr. McDonald has taught courses in instructional design, using stories for learning purposes, project management, learning theory, and design theory. His work can be found at his website: <http://jkmcdonald.com/>



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Designing Technology-Enhanced Learning Experiences

Richard E. West & Bohdana Allman

Learning Design

Instructional Technology

Digital Technologies

Student Learning

The field of instructional/learning design has at times been conflicted about the role of technology in helping students learn (see the classic debate between Richard Clark and Robert Kozma in the “media debate” of the early 1990s—Clark, 1994; Kozma, 1994). While this debate effectively moved the field away from considering digital technologies as the primary variable affecting student learning, these technologies still play an important role in how we learn about, design for, and evaluate learners. In the 21st Century, as networked technologies undergird nearly all human activities, it is nearly impossible to conceive of most instructional situations being devoid of technology entirely.

Indeed, technology may be considered an important layer in most instructional systems, similar to how architectural buildings comprise various layers from the framing to the electrical to (nowadays) the technological. Gibbons (2014) articulated this [layered approach to instructional design](#), arguing that just as multiple layers work together to support the purpose of the building, various design layers must similarly work together within instructional products. As we attend to different elements within instructional design layers, we should consider the content, purposes, and instructional strategies as well as how the instruction is represented and controlled through available technology tools. This enables us to design more effective and purposeful instructional solutions and promote powerful learning experiences.

In this chapter, we attempt to provide suggestions for making instructional design decisions that utilize available digital technologies effectively. We will begin by discussing what instructional technologies are, and how we can incorporate them into our designs. We will review design layers that are particularly relevant when using technology to design instruction and discuss the importance of analyzing the technology’s affordances and matching them to the underlying pedagogical purposes. We will include a discussion about utilizing different models to focus the technology choices on student learning. We then conclude with some challenges to be aware of when integrating technologies into our designs.

What Is an Instructional Technology?

The field of learning and instructional design considers “technology” to be any tool that extends human capability or assists us in achieving a desired learning outcome. In this definition, the technology or tool does not need to be digital. Experts in the field of educational technology often adopt the terms “hard” and “soft” technologies. In this dichotomy, hard technologies refer to machine-based or digital technologies, such as a computer or a web-enabled app, while soft technologies are human-driven processes, methods, and theories that similarly extend or improve our abilities to teach or learn. As an example, in the second edition of the Handbook of Educational Communication Technology, (Jonassen, 2004), there was a section for chapters on “hard” technologies, such as television, virtual reality, and internet-based learning, and a separate section for “soft” technologies such as programmed instruction and game-based learning.

Many of the chapters in this textbook are, in fact, discussing “soft” technologies to support designing instruction (see particularly the sections on instructional design [knowledge](#) and [processes](#)). However, this dichotomy is becoming less relevant, as hard and soft technologies are increasingly considered simply “strategies” for influencing learning and typically involve some combination of process, pedagogy, and digital tools. Our chapter continues to merge these ideas together by discussing “hard” digital technologies specifically, but with strong consideration for their pedagogical fit.

How Can Instructional Technologies Influence Learning?

As mentioned above, technologies are tools that extend human capability, including learning. In the past, educators and instructional designers viewed technologies as primarily hard technologies, a medium to learn *from*. This view was associated with the teacher-centered instruction or transmission model of education and associated theories. The focus was typically on content transmission, practice of basic skills through repetition, reinforcement of desired behaviors, and evaluation of how accurately the learners could respond to pre-programmed questions. The technology may have allowed for some interaction with peers and instructors, but mostly the learner individually interacted with the content in isolation. The learner’s role was to acquire provided information and reproduce it for evaluation. The instructor’s primary roles were to manage the content and evaluate learners’ work. This perspective is still valuable for some tasks and types of instruction. However, alone, these types of activities have only limited power in actively engaging learners in the meaning-making process necessary for successful learning and transferring knowledge to new situations.

As an alternative, Jonassen (1996) envisioned instructional technologies as mindtools that students learn *with*, not *from*, requiring attention to the underlying strategies for using the technology, i.e., soft technologies, in addition to the medium, i.e., hard technologies. This perspective acknowledges that technologies do not directly mediate learning. Learning is mediated by thinking, collaboration, and dialogue facilitated by a variety of tools. Technologies as mindtools support learners as they interpret and organize their knowledge, engage in critical thinking about the content, and actively participate in knowledge construction. Examples of such tools are semantic and conceptual maps (Hwang et al. 2011, visualization tools (Huang, 2020), microworlds and simulations (Warren & Wakefield, 2013), and even emerging technologies such as robotics (Mikropoulos & Bellou, 2013).

Building on this idea of mindtools, and reflecting a general trend in education toward a learner-centered paradigm, the instructional technology field began using technology to mediate meaningful learning experiences and to focus on supporting the learner and the process of learning. Terms such as learning design and technology-mediated instruction reflect this shift in thinking. As Ertmer and Ottenbreit-Leftwich (2013) explained, “technology integration is no longer an isolated goal to be achieved separately from pedagogical goals, but simply the means by which students engage in relevant and meaningful interdisciplinary work” (p. 176).

Learning experiences are now designed with greater emphasis on our understanding of how people learn (Bransford et al., 2000). Learners are viewed as active agents who bring their own knowledge, past experiences, and ideas into the learning process, which impacts how they learn new information. As learners engage in the learning process, they construct and negotiate new meaning individually and with others. The goal of learning is to gain new understanding,

broaden perspective, and apply knowledge in practice rather than to reproduce a specific set of facts. The instructor facilitates the interactions among peers to promote deeper understanding and acts as a guide and a mentor rather than “a sage on the stage.”

In this approach, technologies are used more intentionally as tools that mediate learning in a variety of ways. In this chapter, we will briefly discuss three powerful ways that technology can improve learning through (1) simulating authentic human activity, (2) enhancing interaction among people, and (3) enriching the learning process.

Technologies Can Simulate Authentic Human Activity

Learning, and especially learning of complex professional skills, is optimal when it is contextualized and situated in real-life experiences and authentic activities. Certain approaches use varied technology tools to mimic real-world situations to support learning. For example, computer simulations and [problem-based learning](#) (PBL) use technology to create conditions that are similar to real life and encourage the learner to gain new knowledge and skills through repeated practice and solving authentic problems. [Inquiry-based learning](#) (IBL) encourages the learner to actively explore the material, ask questions, and discuss possible solutions modeling the real-life process of examining issues and systematically looking for answers. Another similar approach, [project-based learning](#) (PjBL) engages learners in authentic and complex projects, often developing a tangible product, enabling learners to actively explore real-world problems and gain deeper knowledge and skills. In all these methods, technologies can be used to create authentic or near-authentic problem-solving scenarios and simulations. Additionally, easier replication of digital problem scenarios enables multiple practice opportunities, and using the actual technological tools of the discipline supports learners as they develop professional skills to practice problem solving while in school.

Technologies Can Enhance Interactions

Digital technology has a tremendous potential to enable interactions and connections between people. Whereas individuals were previously limited by space and time constraints, they can now interact through near ubiquitous access and connection to each other. This has led to the development of several theories of digitally mediated social interaction, such as the [Communities of Inquiry framework](#). This theory describes learning as happening within a community where technology enables different types of human presence:

- social presence (the feeling of being connected and present with each other, for example through video or text discussions designed for students and instructors to learn about each other),
- cognitive presence (the feeling of being intellectually present in the community, growing and developing meaning through interaction, for example through online question and answer sessions or group collaboration via shared documents), and
- teaching presence (the feeling of being supported by a teacher designing and facilitating the interactions and content, for example through well-designed online curriculum and opportunities for feedback).

Collaborativism ([Online Collaborative Learning Theory](#)) is another model of online learning that creates opportunities for meaningful learning experiences through technology (Harasim, 2017). In this process-oriented model, collaborative technology enables students to actively work together, create knowledge, and learn to use the language, analytical concepts, and activities of the discipline while being supported by an experienced educator who helps them move through three stages. In stage 1 (Divergent Thinking), students engage in discussions about a specific problem or a topic. They generate ideas, questions, responses, and solutions based on their personal perspectives and experiences and share them in a group setting. During stage 2 (Idea Organizing), conceptual changes and convergence of different ideas begin as students clarify, organize, and narrow down options through reflection, analysis, and negotiation of ideas that were shared previously. During Stage 3 (Intellectual Convergence), the group is actively engaged in the co-construction of knowledge. Everyone contributes as the group works on a joint knowledge product or solution, which may later extend to an authentic application or be further refined through another collaborative learning cycle.

Technologies Can Enrich the Learning Process

Technologies have a powerful potential to enrich and transform the learning process in ways that may be difficult or impossible without these tools. For example, online and collaborative technologies offer unique affordances that go beyond connecting learners across time and space by enabling easy access to multiple perspectives from diverse populations and across the globe. The asynchronous and recorded character of technology-mediated exchanges enables coherent organization of thoughts, clear and authentic expression, and deep analysis and reflection, which in turn facilitates deeper learning and enhances theory-to-practice connection. The opportunity to create multidimensional and multidisciplinary responses presents authentic evidence of a deeper understanding that goes beyond “correct” answers. Technology also enhances participation opportunities for all types of learners, not just for the traditional mainstream student. Those that may be timid, need more time, or are learning the language are automatically provided with additional support to access the material and interactions in ways that meets their needs. Furthermore, through its flexibility, technology provides access to learning for many non-traditional students as well as busy professionals who may not be able to gain credentials or participate in ongoing professional development in more traditional ways.

How Should We Incorporate Technology In Our Designs?

Entire handbooks have been written about the topic of how to effectively design learning through the support of technologies (see, for example, Bishop et al., 2020; Dillon, 2020; Mayer, 2014; and Stanley, 2013). This chapter cannot expound on all of these theories and ideas, and truthfully, the path of an instructional/learning designer is one of continuous learning—particularly in the area of instructional technologies because these technologies are continually evolving. However, we present two key ideas that will guide you in making wise technology choices in your design work, namely: (1) align technology with pedagogy and (2) focus on what students will do with the technology.

Principle 1: Align Technology with Pedagogy

The quality and accessibility of technology-mediated learning experiences is an issue of both technology and pedagogy. Whether we design a single learning experience, a course, or a full program, strategic orchestration of desired results, assessments, and instructional methods with intentional use of technology are essential. Understanding by Design (UbD) or Backward Design (McTighe & Wiggins, 2005; see also [Dodd, 2020](#), in this book) is a useful framework that helps designers align these essential elements, focus on student learning, and attend to the underlying pedagogy. Rather than the content, materials, or tools dictating what the student should learn, designers pinpoint the most important ideas, knowledge, and skills that the students should learn, and identify appropriate assessments and pedagogies for supporting student learning..

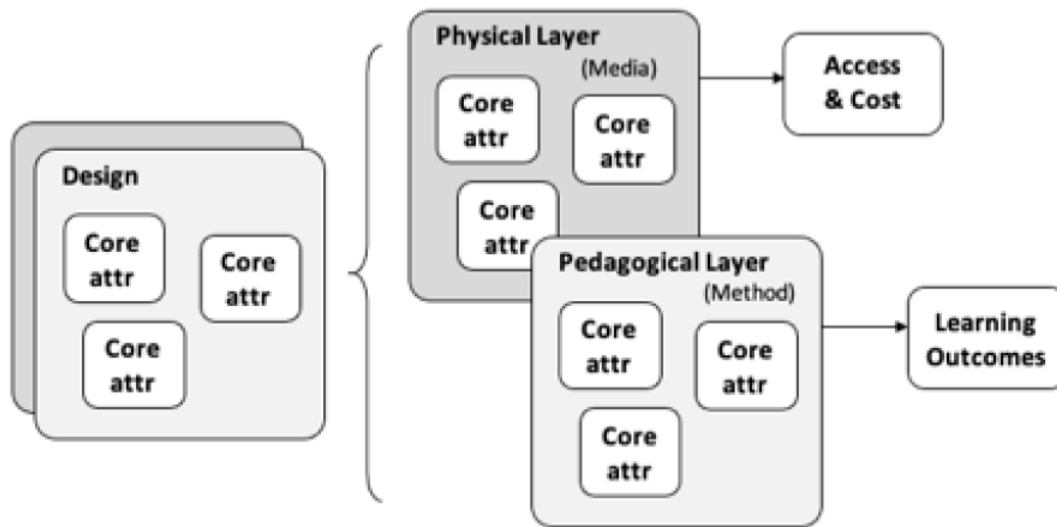
Pedagogy

Pedagogy refers to principles and practices guiding instructional action with a goal to support learning.

Recognizing that technology is a strategic tool encourages designers to deliberately align technology with underlying pedagogical strategies. Any design can be visualized as having two main layers: a *physical layer* and a *pedagogical layer* (see Figure 1). Each layer has distinct core attributes that make the design functional. Core attributes within the physical layer exemplify the surface features of presentation and delivery of instruction and influence access and cost. The pedagogical layer core attributes represent the underlying pedagogical structures and strategies, enable learning to take place, and contribute to successful achievement of learning outcomes (Graham et al., 2014). To increase the effectiveness of any instructional design, the layers and its core attributes should be aligned during the design and development process.

Figure 1

A Visual Representation of Two Design Layers From Graham, et al. (2014).



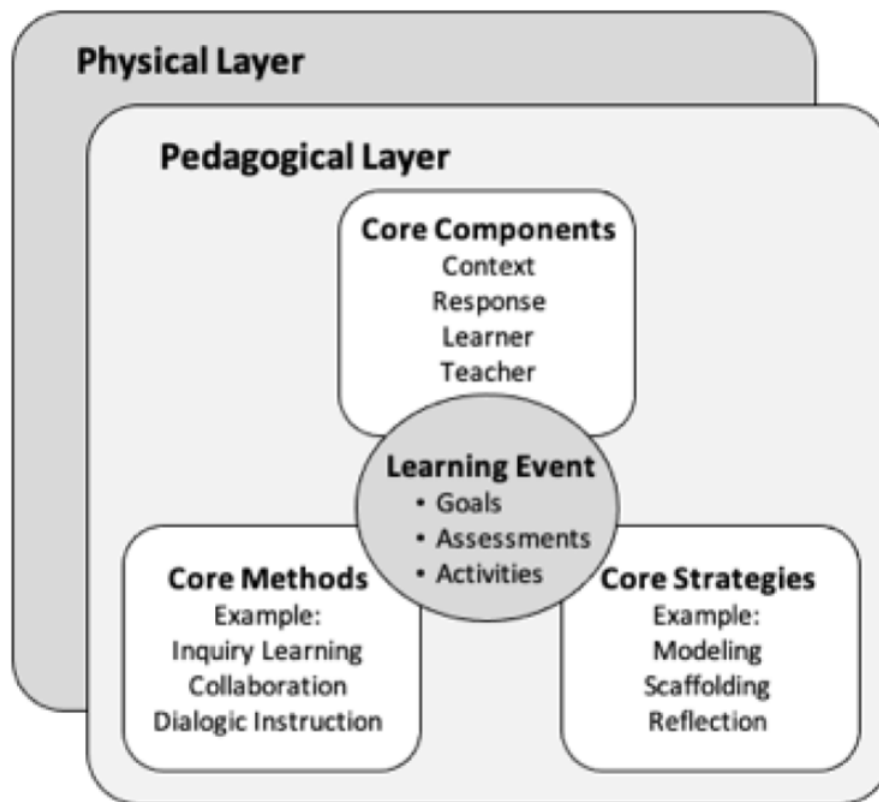
Key Propositions

- (1) Core attributes in the physical affect the potential for attributes in the pedagogical layer
- (2) Physical attributes alone do not directly affect learning

Allman and Leary (2020) studied the process and identified a set of core attributes within the pedagogical layer that drive the two design layers' alignment. This set of attributes, so-called pedagogical intent, pivot around the learning event and encompass core components, core methods, and core strategies (see Figure 2). As designers establish pedagogical intent related to a specific learning event, it is easier to recognize technological affordances that may be needed and match them with available technological tools. The alignment is achieved iteratively through purposefully utilizing available technology tools to fulfill the underlying pedagogical intent requirements.

Figure 2

Pedagogical Intent—A Set of Core Attributes Within the Pedagogical Design Layer.



Affordances

The concept of affordances represents what a specific technological tool can do, as well as, “afford” the user, a designer, a teacher, or a learner, to do. Affordances are determined by the properties of the tool but also by the capabilities of the user.

Although the choices of technological resources are important, it is the pedagogical purposes that should drive the form of instructional design solutions. By allowing the function to guide the form through prioritizing pedagogical purposes and aligning pedagogical and physical design layers, we can design more effective technology-mediated learning experiences and use current technologies in innovative ways.

Principle 2: Identify What Students Will Do With the Technology

In the discipline of instructional/educational technology, researchers have developed many different models for describing how teachers can integrate technology into their teaching. Most of these models focus on how teachers utilize technology. See, for example, the following:

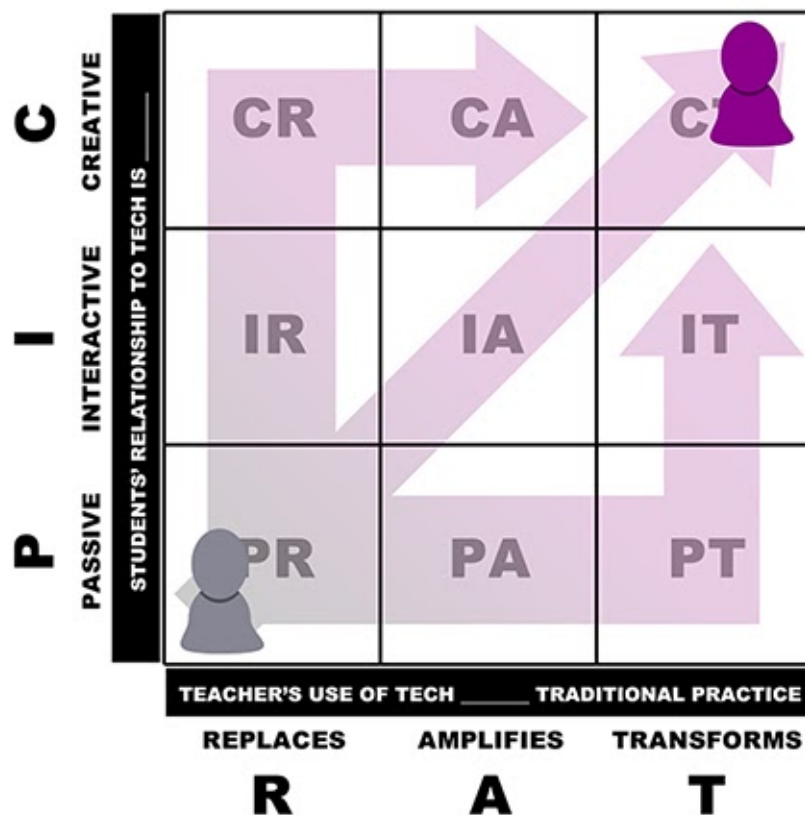
- The TPACK model, which focuses on teacher technological pedagogical content knowledge (Koehler and Mishra, 2009);
- The SAMR model, which focuses on how teachers can use technological strategies to substitute, augment, modify, or redefine their current pedagogical practices (Hamilton et al., 2016);
- The RAT model, which similarly categorizes technology decisions according to whether the technology replaces, amplifies, or transforms the teachers' existing teaching practices;
- The LoTI model, which depicted seven levels of technology use by teachers in the classroom (Moersch, 1995).

While these models can be helpful in teacher preparation programs, they perpetuate a teacher-centric approach to technology use, often ignoring the learner's experience.

PICRAT. However, a new model has been proposed that builds off of the common SAMR/RAT approaches, but turns the emphasis away from what the teacher does with the technology and toward how the student utilizes the technology (Kimmons et al., 2020). In this model, called PICRAT, designers still consider how to use technology to replace, amplify, and transform the learning; but in addition, designers consider what the student is doing as part of the activity: is the student's learning passive, active, or creative? The PICRAT model does not dictate that all good instruction must be transformative or that students must be creative while using the technology. However, it does help teachers and designers to diagnose how often they incorporate activities in each of the squares, and whether they are overusing some strategies to the detriment of others. For example, we often find that designers/teachers overuse technology to replace passive forms of learning (e.g. viewing a lecture, reading a textbook) and PICRAT can stimulate thinking about how to engage students more actively and creatively in their learning with technology.

Figure 3

PICRAT Model



PICRAT for Effective Technology Integration in Teaching



[Watch on YouTube](#)

This video was developed for preservice teachers, and discusses the basic ideas of the PICRAT model.

Challenges When Designing Learning With Technology

In this chapter, we have mostly proposed technology as a powerful asset for designers as they create effective learning, as long as they first, focus on aligning the technology's affordances with matching pedagogies; and second, focus on the students' experiences with the technology. By maintaining these two foci, technology can have a powerful influence on student learning. However, research has provided several additional cautions. We highlight a few important ones here, but be aware that there are many more, and technology, as would be the case with any tool or strategy, should be applied judiciously after careful learner/needs analysis.

Challenge #1: Technology Can Be Distracting

While technology can enhance learning, it can also easily distract from it. We are all familiar with overworked Powerpoint slides or videos where the core message is lost amid spinning graphics, useless animations, distracting photos, or disconnected audio. Richard Mayer, and his collaborators, have outlined key principles for designing effective educational multimedia in their Cognitive Theory of Multimedia Learning, or CTML (Mayer, 1995). These principles are based on core cognitivist assumptions and theories such as dual coding theory (Paivio, 1990) and information processing limits and activity (West et al., 2013). The core idea behind the theory is that of congruence—or that various media should work together, not at disarray, to solidify interpretation of an idea and the development of appropriate mental schemas. More specifically, Mayer and Moreno (1998) identified 5 key principles for designers:

1. **Multiple Representation Principle:** It is better to present an explanation in words and pictures than solely in words.
2. **Contiguity Principle:** When giving a multimedia explanation, present corresponding words and pictures contiguously rather than separately.
3. **Split-Attention Principle:** When giving a multimedia explanation, present words as auditory narration rather than as visual on-screen text.
4. **Individual Differences Principle:** The foregoing principles are more important for low-knowledge than high-knowledge learners, and for high-spatial rather than low-spatial learners.
5. **Coherence Principle:** When giving a multimedia explanation, use few rather than many extraneous words and pictures.

The research on CTML is quite extensive with a great deal of applicability to designers, and you are encouraged to continue your learning in this area by seeking out recent publications on this topic.

Challenge #2: Equity

Although technology has the potential to contribute to equity among learners, it is frequently a great source of inequality with regards to access and usage. Technology is typically adopted faster and in more engaging and innovative ways in schools serving affluent communities. Students in low-income schools may have comparable access to computers while at school but their access to computers and reliable internet may be limited at home. Additionally, low-income schools frequently employ technology for routine drills, content delivery, and in teacher-centered ways rather than facilitating access to knowledge and learning further enlarging the digital divide (Reich, 2019; Warschauer et al., 2004).

Effective use of technology can remove barriers to learning. It can make content and materials more accessible, less culturally biased, and less linguistically challenging. Technology can support educators to regularly assess their learners' needs, promptly respond to their progress, and provide tailored support based on those needs. In order for technology to promote a more equitable learning environment, access to computers, tablets or devices and reliable fast internet connection must be ensured both at school and at home. Next, attention needs to be paid to ongoing professional development and instructional coaching to support teachers, particularly to understand how they can influence student equity.

However, change in teacher practice and effective technology integration occurs gradually. In order to create more equitable learning environments and innovative uses of technology in their classrooms, teachers need to see multiple examples and have opportunities to practice in their classrooms. Finally, to promote equity, it is imperative that we see beyond technology integration and recognize the importance of using technology-generated data to better understand where learners are and monitor their progress as well as utilize learner-centered educational approaches to promote authentic and meaningful learning experiences mediated by technology.

Challenge #3: Media Centrism

The field of instructional design evolved in part from a foundation in educational media. Perhaps for this reason, there is sometimes a bias towards overemphasizing technology in our designs. Throughout the history of our field, we see initial, frenzied excitement over a new technology that eventually is born out to be not nearly as disruptive as originally envisioned (e.g. virtual reality, moocs, interactive whiteboards, clickers, etc.).

Gibbons (2018) outlined succinctly a common pattern for new instructional designers, arguing they begin media centric, because "The technology itself holds great attraction for new designers. They often construct their designs in the vocabulary of the medium rather than seeing the medium as a . . . preferably invisible channel for learning interaction" (para. 3). According to Gibbons, designers then evolve to focus on the instructional message, then the instructional strategy, before finally learning to design according to an instructional model. "Model centering encourages the designer to think first in terms of the system and model constructs that lie at the base of subject-matter knowledge. . . . Then to this base of design is added strategy, message, and media constructs" (para 6).

Because of this inherent bias towards technology as the first solution, designers must practice discipline in not choosing the novel technological choice first before fully analyzing its true affordances.

Challenge #4: Time/Cost/Efficiency Tradeoffs

Technology is often expensive to integrate into a learning environment—particularly if it is a new technology and especially if access must be provided for a large number of students to maintain equity. For example, the ability to teach mathematics to young children using virtual manipulatives using proprietary software on expensive tablets may be superior for some learning objectives to plastic, physical manipulatives. However, would the cost of buying and replacing the tablets be worth it? In addition, how much time will it take to train teachers and students on the new software? How much instructional time will it take in the class period to conduct the activity, including charging the devices, organizing them on the media cart, and retrieving them from students afterwards?

In making decisions about integrating technology into learning environments, designers must not only analyze what decisions will help people learn best, but also which decisions are most practical.

Conclusion

It is clear that technology plays a very important role in our discipline, as many academic programs include the word in the title of their department. However, what technology designers use in the learning environments they create is less important than how they use it. In this chapter, two key principles have been outlined for designing effective instruction with technology: First, match the pedagogy to the technology's affordances; and second, focus on what students will do with the technology, more so than the teacher. Four challenges have also been outlined that are common when technology is used in design, and some suggestions have been provided for confronting these challenges. Perhaps the most important idea is to remember digital technologies, like theories, processes, and models, are tools—and tools are only as effective as the builder and the blueprints that will utilize the tools.

Application Exercise

Consider a time in your life when you needed to learn something difficult. Some examples might be fractions as a child, learning another language, or learning a new routine at work. First, analyze what your needs were as a learner: what did you need to learn, and what made it challenging? Second, describe what kind of technology could have helped you? What affordances of the technology would have made it useful? Third, pick one of the challenges outlined in this chapter and discuss how an instructional designer could have utilized the technology effectively while minimizing those challenges. For example, how could they have reasonably provided equitable access? Or utilized CTML design principles?

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Educational Technology

A History of Research Trends from 1970 to 2020

Abigail Boekweg, Hannah Call, Dillon Crow, Faith Jennings, Julie Irvine, & Royce Kimmons

Educational Technology

Teaching Strategies

Instructional Strategies

New Media

Our goal in this chapter is to explore the history of educational technology research by identifying research trends across the past 50 years. We surveyed 20 representative research papers from each decade ranging from 1970 to 2020. We used bibliometric data to select these representative papers and then qualitatively analyzed and manually coded them. We found that while the particular technologies investigated consistently changed, research generally progressed from addressing theoretical difficulties to determining the affordances of instructional technologies and finally to studying pedagogical strategies. We saw this trend on a macro level, occurring over 50 years. These findings imply that educational technology research (a) is iterative, beginning with the adoption of new technologies by practitioners; (b) relies on determining the effectiveness of instructional technologies; and (c) ultimately investigates teaching strategies related to technology.

Educational technology gradually changed from clay tablets to chalkboards and eventually to Chromebooks. Somewhere in that timeline, the study of educational technology became a formal field of research. Of the 13 journals used in this study, the earliest volume was published in 1953 (though for the 13 journals, the mean first publication year was 1986). This indicates that the field of educational technology research as we know it is less than a century old. Our goal in this chapter is to sketch much of the history of this field by exploring 50 years of educational technology research, from 1970 to 2020.

We have identified the prominent research themes of each decade and discussed how the field has progressed over a 50 year period. To capture a snapshot of each decade, we examined the 20 most cited articles from each ten-year period in order to discover what research made a significant impact through citation counts in each decade. The articles were sourced from 13 educational technology journals. We used bibliometrics to identify these journals and

select articles from each. After identifying the 20 articles for each decade, we manually coded and compared the articles in order to understand research trends. Once each decade was individually coded to reveal the prominent themes, all of our findings were then synthesized to show the overarching patterns and trends in educational technology research over a 50-year period.

Details about our methodology can be found in the “Methodology” chapter of this book. More information about the 13 journals we pulled articles from can be found in the appendix of this chapter.

Literature Review

Many bibliometric studies have been done in the field of educational technology. Most of these studies synthesize research over a short period of time and on a narrow subset of educational technology research. However, our study is not unique in its attempt to analyze research trends over a span of 50 years.

One paper that could be compared to ours is by Bond et al. (2019) in which they analyzed 1,777 articles published in the British Journal of Educational Technology (BJET). Bond et al. also considered 50 years of educational technology research, used a combination of computer analysis and human analysis, analyzed research trends, and organized findings by decade. The study was limited in the following three ways: (a) it considered only articles published in BJET, (b) it did not consider the impact factor of individual articles, and (c) its content analysis favored some decades (especially recent decades) more than others (see Table 1).

Table 1

Publications per Decade in BJET

Decade	Number of Publications
1970s	202
1980s	184
1990s	177
2000s	502
2010s	712

In light of these limitations, our study is needed because (a) it considers a much wider range of journals, (b) it considers only highly cited articles, and (c) it gives equal weight to each decade. Our study produces a holistic picture of how educational technology research has progressed from decade to decade.

In another study similar to ours, Chen et al. (2020) gave a bibliometric review of the topical trends of every article published in BJET during its 50 year lifetime. Our review is, coincidentally, different in ways that were recommended by Chen et al. They suggested that “further investigations may consider extending the analysis and including comparable journals such as Computers & Education in the research area” (Chen et al., 2020). We included 13 journals from the field of educational technology, including Computers & Education. Chen et al. (2020) also recommended that in order to achieve the depth possible through manual coding, future researchers should “survey representative papers, from a qualitative perspective, so as to provide more profound and fine-grained understanding of the domain of educational technology” (Chen et al., 2020, p. 707). We used bibliometrics to select the most cited articles, and then we did qualitative analyses of those articles.

Our findings corroborate many of Chen et al.’s (2020) findings. For instance, a table compiling the most common keywords in the articles Chen et al. analyzed showed a growing diversity in research vocabulary. This was noticeable in our study as well, with the later decades using new keywords and terminology related to emerging technology and

advancing theories. Another overlap is visible in the topics that became more popular over time. Blended learning, mobile learning, and game-based learning were common topics in our findings and Chen et al.'s.

These studies demonstrate the work that has been performed in educational technology research, which supports and overlaps in some instances with our current study. However, we also see gaps that were not previously addressed in these studies, such as analyzing a wide range of journals, focusing on highly cited articles, and equally examining every decade of research. It is our purpose to account for the previous limitations by presenting a broad, encompassing analysis of 50 years in research.

1970s: The Introduction of Visual Communication Media

Many of the technologies taken for granted today were in their infancy in the 1970s. During that time, researchers strove to understand the efficacy and uses of technologies like television and similar visual communication media (graphic displays, picture books, etc.). Research surrounding different instructional methods and theories also abounded as researchers sought to establish the best paradigms to use for education practitioners. The field of educational technology was young but rapidly growing.

Visual Communication Media

The majority of research throughout the 1970s sought to understand the role and appropriate uses of visual communication media in education. Researchers recognized the potential of visual communication media to supplement, support, or possibly replace written and oral presentation of information. Haring et al. (1979) examined how pictures affect childrens' comprehension of written text and found that pictures aiding written text do help with recall of main themes in the written text. Haring et al.'s findings were consistent with Levin et al.'s (1978) major literature review, which emphatically supported the general use of visual communication media to improve learning in children. However, Salomon et al.'s (1972) work was ambiguous about the potential beneficial effect of visual communication media on learning.

While most of the research of the decade supported the use of visual communication media, the need to distinguish which types of visual communication media were most effective for which purposes remained. The research of Hsia et al. (1971) was pivotal in establishing that different types of media affect learners in different ways:

The central nervous system capacity is much less than the sum of [audio] and [visual] modality capacity; therefore, its saturation can be reached by either . . . modality. The very fact that information loss . . . occurs even in an ideal communication situation can be partly explained by the disparity between the capacities of the central nervous system and multimodality (p. 65).

The essence of this comment is that not all information can be absorbed. This is due in part to humans' limited capacity to process information and, in this case, information presented through visual communication media when combined with an auditory stimulus. In a similar vein, Allen et al.'s (1975) work highlighted the reality that more cognitively capable students were able to process more information through visual communication media and suggested that the media used in education be adapted to the cognitive capacities of individual students. Holliday et al. (1976) worked on finding more practical applications for practitioners seeking to use visual communication media effectively.

Through experimenting with multiple modes of visual communication media, Holliday and his colleagues (1976) found that single flow diagrams, or diagrams characterized by their linear and relatively simple flow were more effective than textual description alone, as well as more effective than a combination of diagram and text. He also found presenting big picture information in logical chains using picture word diagrams (PWD) and block word diagrams (BWD), rather than as separate unconnected ideas without diagrams, to be most effective. Dwyer et al. supported a similar idea that "the more realistic a presentation, the more effective the transmission of the desired message" (1970, p. 1). Taken together, these findings prepared the way for future practitioners and researchers alike. Though the role and appropriate

use of visual communication media was still unfolding to researchers, the question of how to use them effectively remained for decades.

Television

Closely related to the research of visual communication was the research surrounding television. The research of the decade on this topic was frequent and intense but not entirely concordant. Television and film were widely accepted as useful tools for transferring information, but researchers were eager to know if these technologies could be used for more substantial learning. For example, Salomon et al. (1972) explored television use in learning by attempting to use filming techniques to replace or supplant more traditional forms of communicating ideas, but their results were inconclusive. Other researchers were interested in whether some of the properties of television were damaging to young children, and they were reluctant to implement it in educational settings. However, Anderson et al. (1977) claimed in their work that there was no evidence that television was harmful to the attention spans of little children. On the contrary, researchers produced evidence that television was actually more effective for instruction than pictures aiding text alone (Spangenberg, 1973) and that some television programs were even effective in teaching children general cooperation and rule following skills (Paulson, 1974). While these findings seemed promising, there was a growing number of researchers who would claim that the positive effects of television and other media forms were not inherent to the technological tools but were actually benefits of the instructional philosophies behind the technological tools which were used in delivering the instruction. This debate grew in the years that followed.

Emerging Theories and Adaptation

Not all of the research of the 1970s was focused on the emerging technologies of the time. Researchers were also spending their efforts advancing their preferred educational theories and philosophies. While some educational theories had already taken root in many institutions, there were still many challenges to these established theories by the research of the time. Merrill et al. (1975) argued that current curriculum development models, though honorable improvements from the past, were insufficient and that curriculum development needed to be more adaptable to the needs of individual learners. Merrill and his colleagues also heavily criticized Cronbach and Snow's Aptitude Treatment Interaction (ATI) method, claiming that it "stops far short of desirable and possible procedures for adapting instruction to individual differences" (p. 4). At the heart of Merrill's alternative was the freedom and ability for learners to make decisions about their own learning so that their needs would be best met. This theoretical debate was one of many at the time. Mangan et al. (1978) urged practitioners to adapt their teaching to be more culturally aware of their learners, and Ausburn et al. (1978) presented evidence of the existence of at least 11 different learning styles. They claimed that while these learning styles did not determine aptitude, the styles should point the way to personalizing and adapting instruction to the needs of specific learners.

1980s: New Technologies and Old Debates

In the 1980s, research in the largely independent fields of education, technology, and psychology began to intersect. The rising interaction between these fields brought many challenges as the paradigms, theories, and interests of the researchers were often inharmonious. However, these challenges also proved useful by bringing attention and refinement to the field of educational technology.

New Media

Many new technologies emerged in the 1980s. Several of the developments at the time were new audiovisual materials, such as television and illustrative aids, but most notable among these technologies were the Walkman, the videocassette recorder, video game consoles, and the personal computer. Each of these unique technologies had been used by the U.S. military and other government organizations for educational purposes in decades past, and with the radical general change characteristic of the 1980s, these technologies were rapidly becoming more accessible to the private and education sectors. This availability meant more developments were on the horizon for the field of

educational technology. Researchers began avidly testing the utility of these potential learning tools and sought to give guidance for how they might best be used in learning across various institutions (Gagnon, 1985; Levie, 1982).

Determining the Role of Technology in Education

Of the many emerging technologies, researchers and practitioners were particularly eager to understand the possible role of computers in providing and assisting with classroom instruction. Consequently, this led to a surge in empirical studies examining the efficacy of computer assisted instruction or CAI (also often referred to as computer based instruction or CBI; Clark, 1985). What in years previous was a congenial discourse about the role of computers in education was becoming a much more heated debate as research findings boomed in support of and against the role and efficacy of CAI. This debate was certainly strengthened in part by one major literature review, which claimed that nearly all of the CAI-related empirical studies of the past, many of which attributed student achievement to CAI, were confounded for not controlling for instructional methods (Clark, 1985). The literature review made the claim that instructional methods, not the implementation of CAI, were responsible for disparities in student achievement (Clark, 1985). Similarly, Dalton et al. (1987) found that students receiving CAI underperformed when compared to their peers who received no CAI but worked in pairs.

Despite such claims against CAI, many of the researchers of the decade produced empirical evidence showing the significant benefits of CAI. Kinzie et al. found “a strong positive effect of computers on continuing motivation” (1989 p. 12), while Tennyson et al. (1980) showed how computers can aid and empower learners in taking control of meeting their own learning needs. This was similar to Dalton et al. (1987), who claimed that computers aid instructors and practitioners in providing personalized learning experiences to students. Yet the research of the decade continued to be rife with conflicting opinions as researchers sought to understand and define the role of technology, specifically computers, in education.

Applying Technology Through Behaviorism and Cognitivism

Behaviorism was a dominant theory used in instructional design models during the 1980s. Because of this, researchers noticed some of the drawbacks of the behaviorists’ theoretical approach and called for more methodologies to be applied to instructional design, namely cognitivism (Clark 1985). Hannafin et al. (1989) were adamant about the benefits of allowing room for multiple psychological theories to guide instructional designers in meeting the needs of students and stated the following:

The differences between behavioral and cognitive strategies involve more than mere semantics. Considerable research exists suggesting qualitative and quantitative differences in learning might result from each. The issue is not which models are best, but which design decisions are most appropriate given the demands of the learning tasks (p. 98).

Studies from the decade show that researchers began designing to test the uses of cognitive theory in educational technology (Butterfield, 1989; Clark, 1985). Clark et al.’s (1985) article showed that instructional designs using a behaviorist approach were most effective in promoting short term memory of declarative or factual information as well as procedural tasks, while instruction designed using a cognitivist approach was more effective in promoting long term memory and the ability to creatively apply learned concepts in multiple new contexts. Butterfield et al. (1989) were also strong proponents of using cognitive theory to improve instructional methods and outcomes. These findings precisely supported the work and comments from Hannafin et al. and advanced the ongoing discussion about how differing psychological theories could be applied in educational technology.

Naturalism Versus Rationalism

Throughout the decade, researchers also questioned the utility of different paradigms and modes of inquiry for research in the field of education and technology. At the forefront of this debate were the naturalistic and rational modes of inquiry. Rationalistic inquiry, often referred to as rationalistic research or scientific inquiry, is a mode of inquiry that relies heavily on reason and experimentation as the path to a true understanding of the world. It also claims that all events in the world have a cause and effect or that the world is deterministic. Rationalistic inquiry is almost always carried out

with quantitative research methods, and it had been the dominant mode of scientific research for the past century and a half (Guba, 1982). In contrast, naturalistic inquiry, often referred to as naturalistic observation, is a mode of inquiry that relies primarily on observation of the natural world without any attempt to manipulate that which is being observed. Naturalistic inquiry is most often associated with qualitative methods of research.

Despite the dominance of rationalistic inquiry, researchers of the decade had little trouble finding fault with this mode of inquiry. For example, much of the criticism was reflected by Guba et al.'s (1982) statements about how "the rationalistic model is difficult to apply and results [are] used infrequently" as well as how "practitioners lack the insight and creativity to see how research results can be applied" (p. 235). These types of obstacles were particularly emphasized by proponents of naturalist inquiry who were hoping to broaden the field's tools of inquiry. Proponents of naturalistic inquiry were quick to defend the unique insights that this type of inquiry could produce, especially in light of rationalism's shortcomings, but the true challenge with accepting naturalism lay with its lack of clear, trustworthy criteria by which the findings from this mode of inquiry could be generalized to larger populations (Guba, 1981).

1990s: Technology and Theory

In the 1990s, the internet became a global, public network and grew from one site in 1991 to over three million sites in 1999. Yahoo, Amazon, and Google were founded. Web browsers, PalmPilots, and SMS text messaging were invented. Digital cameras and CDs became affordable. Notwithstanding these technological advancements, the 20 most cited articles of this decade were mainly concerned with deepening the theoretical foundations of the field rather than exploring new technology.

Of the 20 most cited articles from the 1990s, 17 were theoretical. The overrepresentation of theoretical papers in the 1990s may have been a response to the debates and conflicting findings of research from the 1980s. Some authors wrote about problems with existing theoretical frameworks and proposed new frameworks. Other authors explained and defended their theoretical bases in order to make more compelling arguments about the proper use, development, or evaluation of educational technology. The most cited article of the decade (Garrison et al., 1999) did both. Garrison et al. (1999) proposed a theoretical framework and argued that it was a proper template for evaluating the educational merits of computer conferencing.

Technology

Even though theory was making the biggest impact on the field, there were plenty of practical discussions about the use of technology in classrooms. Some of the articles indicated that not enough was being done to use and integrate technology in the classroom. For example, Ertmer (1999) stated that schools had done little to change in response to the affordability of computing power. However, other authors cautioned against over-enthusiasm for technology.

One of the major debates over technology during the 1990s occurred between Kozma and Clark. Their debate centered on the role of technology in fundamentally changing education. The debate also discussed whether changes in technology had a transformative effect on education or if changes in technology were merely improvements in efficiency. Kozma (1994) claimed there was an urgent need to understand the relationship between technology and learning to facilitate the integration of emerging technologies. He argued technology had the potential to significantly impact how students learn and construct knowledge. In contrast, Clark's (1994) response was while media is necessary to deliver instruction and can decrease the cost of doing so, media is never directly responsible for learning. He critiqued the emergence of unrestrained support for technology in the field, claiming technology does not fundamentally change learning. Clark also warned that researchers who indicate media is responsible for learning are likely misinterpreting their findings and are possibly laying a groundwork for inadvisable investments. This debate over the role of technology in education opened a discussion on technology integration that even affected other fields in education research.

Kozma and Clark's debate impacted other researchers as well. In an earlier article supporting Clark's argument, Johnstone (1991) argued that teachers' enthusiasm for new technologies for classroom demonstration (like ticker

tapes and the Wilson Cloud Chamber) were partly to blame for why science is difficult for students to learn. In support of Kozma's position, Jonassen and Rohrer-Murphy (1999) claim technology allowed us to accomplish innovations in areas like instructional design that would not have been possible without technology. This debate continued in succeeding research, it and posed questions that impacted the field of educational technology for many years.

Aside from debating the integration of technology in the classroom, researchers also discussed different types of commonly used technology. Computer technology was the most common, and video technology was the second most common. Authors would either talk about technology in broad terms ("computer technology," "media," etc.) or be very specific ("ASK Jasper," "GeometryTutor," etc.), rather than talking about established categories of technologies. Researchers in the 1990s employed a less stratified vocabulary for technology than we have today.

Discussion

Constructivism gained popularity in this decade. Prior to the 1990s, instructional systems technology (IST) scholars had been actively rejecting the behaviorist foundation of IST (Jonassen, 1991) and the field of instructional technology had become increasingly accepting of the constructivist philosophy of learning (Rieber, 1996). During the 1990s, activity theory was being used to realize constructivist practices (Jonassen & Rohrer-Murphy, 1999).

Among the articles we considered for this decade, there were 40 distinct keywords or key phrases, including "paradigm shift," "media theory," "theoretical underpinnings," "conceptual framework," and "early discussion." These key phrases point at the overrepresentation of theory in the 20 articles from the 1990s. Only three of the 20 articles in this decade were experimental (Mayer et al., 1995; Hill & Hannafin, 1997; and Byrne et al., 1999), and two of these were the least cited of the 20 (Mayer et al., 1995 and Byrne et al., 1999). Perhaps these three articles were early indicators of a shift to empirical research in the 2000s.

The 1990s were a formative time for educational technology research. Regarding the 1960s, Johnstone (1991) wrote "[they] made us stand back and ask serious questions about science, its concepts, its overarching theories and insights, its consequences, its issues and its place in education and in society in general" (p. 75). Something similar happened in the 1990s. During this time, researchers pondered the place of computer technology in education, what insights it could provide, and what theories could or should drive its development.

2000s: Students and Technology

At the beginning of the 21st century, expanding uses for technology were paralleled by a dramatic increase in access to technology. These twin advancements brought with them several research questions concerning learners of this new age—learners who had been surrounded by technology since childhood. New debates arose about this upcoming computer-literate generation (often referred to as "digital natives"), and a dialogue ensued concerning the needs of these new students, the technological advancements and proper ways to integrate unfamiliar resources in the classroom (Hew & Brush, 2006; Ertmer, 2005), and the underlying strategies to best help learners and teachers with emerging educational materials.

While the '90s gave us much research focused on the theoretical implications of educational technology, the 2000s showed a major jump to empirical studies and tests related to these questions. Several controlled experiments and randomized survey-based studies were at the forefront of the research. Of the top 20 articles analyzed for this period, 13 were empirical studies. The first seven articles of the decade—which span from 2000 to 2007—were either theoretical papers or literature reviews. The remainder of the articles—spanning only from 2008 to 2009—were all reports on empirical studies. This shows a major shift in the most common research strategies as well as a shift in which articles were most likely to be cited.

Looking at the common themes researchers of this decade focused on helped us identify the issues researchers were most concerned with and the state of technology in education during the 2000s. The most common research topic during the 2000s was "e-learning" with three articles using the term e-learning directly in the titles and five articles

listing the term as a keyword (Sun et al., 2008; Liaw, 2008; Park, 2009; Motiwalla, 2007; So & Brush, 2008). Other important topics researched in the 2000s were (a) blended learning, (b) mobile learning, gamification, and Facebook, and (c) pedagogy.

E-Learning

The first publication on e-learning we analyzed in this decade was a general analysis of e-learning participants and their course satisfaction (Sun et al., 2008). Those authors conducted an empirical study to discuss what created a satisfying e-learning environment and what influences contribute most to a learner's experience. The results of the study concluded that "learner anxiety toward technology is one of the biggest influencers in a learner's satisfaction" (2008, p. 1194).

The second article concerning e-learning similarly analyzed the overall learner satisfaction in online courses, but it also focused on the effectiveness of the course layout using the software Blackboard as an empirical case study (Liaw, 2008). In the third e-learning article, the discussion was more narrowed, focusing on the use of the Technology Acceptance Model (TAM) within an e-learning design (Park, 2009). TAM is a theoretical model used to explain user behavior in technology by analyzing the perceived usefulness and perceived ease-of-use, which are believed to directly influence how the technology will then be used.

Blended Learning

Blended learning was another repeated topic. In 2004, Garrison and Kanuka defined blended learning as "thoughtful integration of classroom face-to-face learning experiences with online learning experiences," and argued that, "blended learning is consistent with the values of traditional higher education institutions and has the proven potential to enhance both the effectiveness and efficiency of meaningful learning experiences" (Garrison & Kanuka, 2004, p. 95).

Four years later, So and Brush (2008) investigated a more focused aspect of the topic: student interactions and relationships in a blended learning environment. In their study, they analyzed empirical research supporting the claim that student perceptions of collaborative learning have statistically positive relationships with perceptions of social presence and satisfaction.

Mobile Learning, Gamification, and Facebook

Three other topics that were repeated in the early 2000s were mobile learning, educational gaming, and Facebook. Two mobile learning articles were published in 2007 and 2009, the first presenting an evaluation of mobile learning in general (Motiwalla, 2007) and the second focusing on gender and age differences in mobile learning (Wang & Wu, 2009).

Gaming in education was addressed in two articles in this decade. Kiili's (2005) article, "Digital Game-Based Learning: Towards an Experiential Gaming Model," presented the "flow" theory model (Csikszentmihalyi, 1975) and argued that game learning creates an engaging environment for students to experience flow (e.g., highly absorbed or focused interest). Papastergiou's (2009) article, "Digital Game-Based Learning in High School Computer Science Education: Impact on Educational Effectiveness and Student Motivation," also centered on the effects of gaming in education. She analyzed the comparisons of students participating in game-based curricula as opposed to those who were not and found that the students in game-based learning exceeded the performance of those in the original format.

The last of these three topics, Facebook, was discussed in two separate articles that were both published in the same journal (*Learning, Media and Technology*) and on the same day in 2009. Selwyn's piece, "Faceworking: Exploring Students' Education-Related Use of Facebook," analyzed the use of Facebook among university students to determine if it was an asset or hindrance in education. The other article explored the social aspect of the platform to see how university students shared informal information related to their classes in an effort to connect socially with other students (Madge et al., 2009).

Pedagogy

The remainder of the articles in this decade dealt with pedagogical-related topics broadly in connection with technology. “Toward a Design Theory of Problem Solving” (Jonassen, 2000) articulated the need for a problem-based learning design in our school systems and only briefly mentioned technological devices students may encounter. As opposed to advocating for one learning model, Merrill (2002) presented several different models and discussed the underlying principles of pedagogy design that connected and supported them all. Ertmer (2005), as mentioned earlier, was concerned with the pedagogical beliefs of teachers in relation to their classroom practices, and she presented research which suggested many teachers have learning beliefs that are not carried out in practice. Two other articles explored the principles of learning design in a digital environment and discussed ways to enhance teaching with technology (Angeli & Valanides, 2009; Wang & Hannafin, 2005). Lastly, the ‘Digital Natives’ debate was discussed by Bennett et al. (2008) and Kennedy et al. (2008) as a means of addressing the learners of this generation. Both articles questioned the reality of this “new breed” of learners and argued that while learners of the generation were exposed to technology more than previous generations, they were not automatically experts and did not have different pedagogical needs than previous generations.

Reviewing the topics holistically, we see the themes of e-learning, blended learning, gaming, mobile learning, Facebook, and pedagogy leading the research of this decade. With many of the above examples, we can also notice a trend of initial research being more broad and encompassing in its scope, and later studies on the same topic being more narrow, focusing on a targeted aspect of the subject. For instance, the first e-learning article that was analyzed provided a broad study on e-learning satisfaction, while the later articles focused on specific software or a particular aspect of e-learning interaction.

Discussion

Both of the articles discussing Facebook conducted surveys and analyzed a large collection of Facebook posts to provide data for their research (Madge et al., 2009; Selwyn, 2009), while the mobile learning articles used similar methods of data collection (Motiwalla, 2007, & Wang & Wu, 2009). Several of the e-learning, blended learning, and pedagogy with technology articles were heavily based on surveys but also included face-to-face interviews (Garrison & Kanuka, 2004; So & Brush, 2008; Merrill, 2002; Park, 2009).

Research in the 2000s focused on advances in technology such as e-learning, Facebook, blended learning, digital native, learner satisfaction, TAM, environment, and technology integration. We can see that with growing technology, the diversity of models and platforms for how technology could be used in education rapidly expanded. The research of this decade rose to meet the developing questions by addressing these new and various topics, conducting empirical studies to assess tangible implications, and presenting ideas to help educators and researchers moving forward.

2010s: Mobility, Connectivity, and Flexibility

The already brisk pace of technological advances in the 2000s accelerated during the 2010s. At the beginning of the decade, only 20% of mobile phone users were on smartphones, or phones that could access the internet, but by 2019 that percentage had grown to 70% (Kremer, 2019). People grew comfortable using their mobile phones not only for entertainment but also for shopping, banking, social networking, and education. This integration of mobile technology into everyday life had an immense impact on educational technology.

More people using smartphones meant more people were playing mobile games, and this sector of the gaming industry grew rapidly. Educators and researchers began examining how incorporating game elements (i.e., gamification) into educational situations could impact learning. Along with gamification, educators were also interested in how to harness social networking and augmented reality to bolster learning. Besides being interested in educational technology itself, researchers were also curious about the ways technology could be utilized to improve the traditional classroom experience.

Out of the 20 most cited articles from this decade, 13 were literature reviews. The other main direction of inquiry during this decade was learning how specific technologies or interventions impacted education. Besides the 13 literature reviews, the remaining seven articles analyzed for this section were empirical studies focused on the impacts of specific technology-driven educational interventions.

Mobile Devices in Learning

As mobile devices became more widely used by the general populace, research involving mobile devices grew in popularity as well. Gikas and Grant (2013) examined the perspectives of these “new, 21st century” students regarding mobile devices and social media. They collected data by conducting focus groups of university students in the attempt to answer the question, “What are students’ experiences when mobile computing devices are integrated into higher education courses?” (p. 18). They found that students’ mobile device use often allowed them to access course content anywhere and empowered them to “captur[e] information outside of the learning environment and mak[e] connections with the material” (p. 24). This finding that “learning happens regardless of location” is one of the main findings of Gikas and Grant’s study (p. 25).

Sung et al. also examined mobile technology’s impact on learning in their 2016 article. They examined 110 journal articles that addressed the use of mobile devices in teaching and learning. Of the 110 articles, about 73% examined hand-held devices while approximately 22% studied laptop usage. The most popular learning stage to study was higher education (43 studies), followed by elementary schools (38 studies; p. 258). While the portability of hand-held devices may encourage their use in nontraditional settings, the classroom setting was the most studied with half of the examined studies focusing on it.

Social Media

In 2011, Junco et al. examined the effect of Twitter on the grades and learner engagement of college students. They found that “using Twitter in educationally relevant ways had a positive effect on student engagement” and a positive effect on grades (p. 128). The following year (2012), Junco published another paper on student engagement, this one focusing on how it was impacted by Facebook. Junco’s Facebook study found that time spent on Facebook or engaged in Facebook activities yielded mixed results depending on the specific variable being considered (p. 170). Other researchers were also interested in Facebook’s influence. Roblyer et al. (2010) surveyed both college students and faculty to compare usage and attitudes regarding Facebook and found that faculty and students did not use Facebook much for educational purposes (p. 138).

Another article we analyzed examined how social media can empower learners to customize their Personal Learning Environments (PLEs). In their 2012 article, Dabbagh and Kitsantas described how social media had enabled learners to “create, organize, and share content” by creating their own PLEs, which allowed them to curate and share content as they saw fit (p. 4). They cautioned that not all students possess the “knowledge management and the self-regulatory skills” needed to create the PLE they desire for their learning experience and advocated “teaching students to become effective self-regulated learners” so they will have the skills needed for “creating, managing, and sustaining PLEs using a variety of social media” (p. 7).

Understanding Teacher Attitudes

With social media and technology evolving so rapidly during the 2010s, Ertmer et al. (2012) sought to analyze the beliefs and practices of teachers as they related to technology and student-centered learning. They found that “in general, teachers were able to enact technology integration practices that closely aligned with their beliefs” (p. 432), which they saw as a change from Fang’s 1996 research finding that while “teachers could articulate their beliefs, practices were influenced by ‘classroom realities’” (p. 432). Ertmer et al. gave some possible reasons for teachers’ new ability to align their technology practices with their beliefs: (a) increased student access to computers and online learning resources (i.e., Web 2.0), (b) increased teacher understanding of the “new, 21st century student,” and (c) increased changes in curricular emphases (p. 432).

Others were also interested in teachers' adoption of technology in their classrooms. In their 2019 paper, Schere et al. attempted to use the TAM to explain and model teachers' adoption of digital technology. This interest in the TAM is a continuation from scholars' interest in the 2000s. Schere et al. explain the continued interest in the TAM thusly:

The TAM has gained considerable prominence, particularly due to its transferability to various contexts and samples, its potential to explain variance in the intention to use or the use of technology, and its simplicity of specification within structural equation modeling frameworks (p. 14).

Gamification

Along with mobile learning, another aspect of online learning that students grew more familiar with during the 2010s was gamification. Educators sought to harness their students' enthusiasm and familiarity with gaming by incorporating elements such as "the use of narratives to change the context around a typical activity, the creation of social competition, and the incentivizing of behavior through badge and reward systems" (Hanus & Fox, 2015, p. 152). During the 2010s, schools began to embrace elements of gamification, but clear evidence of which gamification elements had the most beneficial impact was lacking.

The obstacles to distilling learners' experiences into empirical data are reflected by the details of Connolly et al.'s (2012) systematic literature review of empirical evidence on computer games and serious games. Connolly et al. gathered 7,392 papers using key words such as "computer game," "video game," and "games-based learning." However, after applying criteria requiring papers to include "empirical evidence relating to the impacts and outcomes of playing games" they narrowed the list to 70 papers, less than 1% of the original list (p. 666). This meant less than 1% of the papers they initially gathered met their requirement for high quality empirical evidence.

In Connolly et al.'s opinion, "The most notable point about the current review was the diversity of research on positive impacts and outcomes associated with playing" (2012, p. 672). The 2010s saw a wider acceptance from the public of using games to improve learning outcomes. While puzzles and simulations were the most common types of games used in learning, Connolly et al. sought to "develop a better understanding of the tasks, activities, skills and operations that different kinds of games can offer and examine how these might match desired learning outcomes" (p. 672). According to our research, Connolly et al.'s review was the most cited article from the 2010s, with 1,270 total citations, and has become a touchstone for gamification research.

Acknowledging the continued interest in digital games, Boyle et al. revisited the topic in 2015 and updated Connolly et al.'s systematic literature review. Three of the scholars from the original Connolly et al. paper also contributed to the Boyle et al. update. For their updated review, they coded the reviewed papers by geographical location, and the wide distribution of papers showed that research on games was being conducted worldwide: United States (53), Europe (45), Asia (26), South America (5), and Australia (5; p. 181).

In their 2015 mapping study, Dicheva et al. searched the research for papers presenting empirical studies regarding gamification as used in education. According to them, "the most used gamification design principles in educational context are visual status, social engagement, freedom of choice, freedom to fail, and rapid feedback" (p. 79). Within the papers they analyzed, the most popular game mechanisms cited were points, badges, and leaderboards (p. 80).

This emphasis on elements designed to set learners apart from one another may be one of the most common elements of gamification within education. However, according to Hanus and Fox (2015), it may cause harm to learning outcomes (p. 159). Hanus and Fox's longitudinal study of student outcomes from a gamified course compared to a traditional course found that students in the gamified course decreased in satisfaction, motivation, and empowerment relative to the non-gamified course (p. 159). They suggested that "giving rewards in the form of badges and coins, as well as encouraging competition and social comparison via a digital leaderboard, harms motivation" (p. 159). Since their studied class was an elective, they assumed that students who took the class did so because they were at least somewhat interested in the material and suggested that "when a reward system is imposed on top of a class students already find interesting, it may feel constraining and forced" (p. 159).

While Hanus and Fox attributed negative impacts on motivation to certain gamification elements when the learner was already interested in the subject, they proposed that incentives could increase intrinsic motivation for boring tasks and so they viewed gamification as “a double-edged sword” (p. 160). Gamification could possibly help motivate learners regarding tasks they viewed as boring, but it also appeared to smother existing intrinsic motivation learners had for subjects that already interested them. Domínguez et al. (2012) designed gamified alternatives to exercises in an existing course and students had the option of doing the traditional exercises or the gamified versions. They found that some students had mixed feelings about games, citing a “dislike and uneasiness created by the leaderboard and the feeling of competition among students” (p. 390). These findings supported the existing thought that while gamification could be a benefit in the classroom, there were certain significant drawbacks to its use.

Flipped Classrooms

Access to mobile devices or computers is essential for students to participate in “flipped classrooms,” a model which grew in popularity during the 2010s. With flipped classrooms, what was “previously class content (teacher led instruction)” is replaced with “what was previously homework (assigned activities to complete) now taking place within the class” (O’Flaherty & Phillips, 2015, p. 85). This method of instruction emerged in the 2010s in response to increased access to technology and understanding of its benefits.

In their systematic review of literature pertaining to flipped classrooms, Akçayır and Akçayır (2018) found that the number of articles published on the topic steadily increased from one paper in 2012 to 32 papers in 2016, reflecting increased interest in the model by scholars (p. 337). One reason for this interest that O’Flaherty and Phillips (2015) suggested was “The flipped classroom foster[ed] student ownership of learning through the completion of preparatory work and being more interactive during actual class time” (p. 85).

Besides student ownership, other benefits of flipped classrooms scholars have found include “enhanced learning motivation and students’ positive attitudes” (Akçayır & Akçayır, 2018, p. 343). However, questions remained about whether these benefits were due to active learning rather than the flipped model itself. As Akçayır and Akçayır (2018) asked, “if a researcher use[d] active learning strategies in a traditional course instead of flipping the classroom, would s/he gain the same positive academic outcomes?” (p. 343). They went on to posit that “if the answer is ‘yes,’ then maybe there is no need to devote considerable time to designing and implementing the flipped classroom (developing video lectures, quizzes, etc.) or to subjecting students to large changes in their instructional format” (p. 341). This study called into question the need for the widespread implementation of flipped classrooms and provided suggestions for research on active learning instead.

MOOCs

The term MOOC (Massive Open Online Courses) was described as “the educational buzzword of 2012” (Liyanagunawardena et al., 2013, p. 203). MOOCs are online courses that typically offer free enrollment. Jordan (2014) reported that a survey in February 2013 suggested that the average MOOC enrollment was 33,000 students with an average of 7.5% completing the course (p. 134). In her paper, Jordan gathered enrollment numbers and completion rates as they were available from public sources online.

According to Jordan’s data, total enrollment in MOOCs decreased over time from October 2011 to July 2013 (p. 145). She also found a trend that enrollment in a MOOC increased as the course length in weeks increased (p. 146). However, as course length grew, a smaller proportion of students completed the longer courses (p. 148).

Augmented and Virtual Reality

In the 2010s, advances in augmented reality (AR) and virtual reality (VR) technology led to increased research interest in how AR and VR could be used in education. Wua et al. (2013) conducted a literature review which gathered and analyzed 54 articles dealing with AR in education. They argued that “viewing AR as a concept rather than a type of technology would be more fruitful for educators, researchers, and designers” (p. 42). While viewing AR as a concept, Wua et al. explored different ways AR could be used in instruction and issues that possibly impact such usage.

In a similar fashion, Dalgarno and Lee (2010) examined the learning affordances of 3-D virtual environments (VE). They suggested that “because 3-D technologies can provide levels of visual or sensory realism and interactivity consistent with the real world, ideas learnt within a 3-D VE should be more readily recalled and applied within the corresponding real environment” (p. 21). This was supported by Merchant et al.’s (2014) finding that “the effectiveness of games was the same whether students were assessed immediately or after the passage of time,” which indicated to them that “students learning in games have retention level beyond short-term learning” (p. 36).

Discussion

The 2010s brought dramatic technological changes to societies and classrooms worldwide. The terrain of educational technology was shifting rapidly and many researchers sought to understand the new realities of classrooms on the ground. Researchers also sought to find their bearings and map which specific aspects of education technology had already been studied by their colleagues by conducting literature reviews. The 20 most cited articles from this decade revealed that researchers were especially interested in how learners were impacted by mobile learning, social media, gamification, MOOCs, and augmented and virtual reality. The articles analyzed for this section were primarily concerned with the following questions: (a) “How does the integration of mobile technology into everyday life impact educational technology?”, (b) “In general, how can educational technology improve learning?”, and (c) “How do specific technologies impact learning?” The rise of mobile devices and wider adoption of online learning enabled teachers and learners to experience new models of learning such as flipped classrooms and to envision more flexible learning environments.

2020 and Beyond

There are intrinsic constraints with discussing a decade while it is still in its infancy. We would argue that the period of scholarly discourse in educational technology that began in 2010 ends, not on December 31, 2019, but once the ramifications of the COVID-19 pandemic of 2020 became apparent. Many of these articles were written before the pandemic reached global proportions and they explored similar themes as those articles analyzed from the 2010s: (a) the use of gamification in education (Troussas et al., 2020; Zainuddin et al., 2020), (b) the impact of the flipped classroom model on students (Turan & Akdag-Cimen, 2020; Lo & Hew, 2020; Bond, 2020), (c) the application of virtual reality in education (Radianti et al., 2020), and (d) the adoption of new learning technologies (Liu et al., 2020). However, three of the articles from 2020 focused on the pandemic and its impact on the field of educational technology.

The abrupt shift to remote learning related to the COVID-19 pandemic strained the capacities of educators, schools, students, and families worldwide. Two of the articles in this section discuss impacts of the COVID-19 virus. The article by Almaiah et al. (2020) asked how regional e-learning systems were affected by the COVID-19 pandemic and discussed the main challenges and factors that led to successful usage of those systems. The researchers’ list of critical factors that need to be addressed for successful usage included the following: (a) technological factors, (b) e-learning system quality factors, (c) trust factors, (d) self-efficacy factors, and (e) cultural aspects (p. 5273). We anticipate that many other scholars will examine the impact of COVID-19 with similar papers in the months and years to come.

Rather than analyze the effects of the pandemic on specific learning environments in their editorial, Williamson et al. (2020) explored the macro view of how the pandemic will shape pedagogy going forward.

A distinctive approach to pedagogy has emerged as a global norm in the opening months of 2020. Distance education, remote teaching, and online instruction are not new approaches to pedagogy or curriculum design, but they have taken on renewed salience (p. 108).

Williamson et al. urged caution regarding the “educational platformization” and decentralization of public schooling necessitated by the pandemic (p. 108). They speculated the following:

The current state of ‘pandemic pedagogy’, in other words, may not be seen by some businesses as simply an emergency response to a public health and political crisis, but as a rapid prototype of education as a private service and

an opportunity to recentralize decentralized systems through platforms (p. 109).

This concern that Williamson et al. have of public education morphing into a decentralized system enabled by the use of private platforms called for critical studies of these “changes in the broader political economy of the COVID-19 pandemic, its antecedents, and long-term consequences” (p. 109).

A major concern Williamson et al. address in their editorial is the inequality among students, especially the lack of access many students had at home to distance learning (p. 110). They cautioned that such inequality could not simply be solved by giving students laptops for home use and that as the pandemic continued inequalities in society were likely to widen (p. 110). Williamson et al. urged us to “see this time as an important moment to support, regulate and design an inclusive digital future for us all, that is part of a society that is more socially just” (p. 111).

At the beginning of the 2020s, educational technology research was still concerned with understanding the effects of technology on pedagogy in both general and in specific instances. However, the dependence on distance education necessitated by the COVID-19 pandemic exposed the inequalities that existed in many educational systems and highlighted many questions about “politics, pedagogies, and practices” (Williamson et al.) that will need to be answered in the future.

Synthesis of 50 Years

In this section, we will discuss or summarize the themes common to every decade, important themes unique to particular decades, the evolution of educational technology, and the probable future trajectory of educational technology research.

Core Question

As we look back over 50 years of research and try to sketch a holistic picture of the field of educational technology, we note a few significant themes. The main theme that was common in every decade was research that questioned the effectiveness of specific educational technologies. For this reason, it seems a fair assessment to say that the core question of educational technology research is—or has been for 50 years—whether a particular educational technology is effective. While this is a simple question, educational technology research has remained dynamic and complex for over 50 years. This, of course, is due to the constant innovations in educational technology that allow that core question to be asked again and again, always of a new technology (and sometimes before anyone is fully done studying the old technology). If technology were static, then educational technology would very likely become a closed question.

Technological developments have frequently altered the relevance of research topics. In the '70s, audiovisual aids in learning were the most technologically relevant. By the 2000s, e-learning was the most relevant discussion. During the 2010s, gamification was used in the hopes of increasing learner engagement. Increased access to tech and mobility led to experimenting with flipped classrooms, MOOCs, and how social media could be used to increase engagement. The increasingly rapid pace of technological advances has outstripped researchers' ability to compete with the new information. As this chapter illustrates, educational technology research does not always focus on the newest available educational technology. Instead, researchers typically study new technology after it has made its way to the classroom (Kimmons et al., 2021). In the field of educational technology, the efforts of practitioners and researchers are closely intertwined, with researchers often considering which innovations practitioners are making in their classrooms as they consider which questions to study. It is a different model than, for example, the medical field, where research is carried out before adoption by practitioners. This symbiosis with practitioners creating innovations and researchers then mapping and verifying them increases the relevance of research to real life classrooms at the same time it necessitates a lag between the release of new technologies and research concerning them.

Important Trends

Continuing from the 1970s through the 1990s, theoretical analyses appeared in—and eventually even dominated—the highly cited research of each decade. However, from the 2000s onward, theory was no longer the focus of the most cited articles. Theoretical trends during the first three decades should be expected because the field was quite young in the 1970s, troubled by conflicting paradigms in the 1980s, and still grappling with those conflicts even as the internet exploded onto the scene in the 1990s. Even with the introduction of the internet, the most cited articles from the 1990s do not directly concern technology, instead focusing on conflicting theories and models.

What were these theoretical difficulties and disagreements that concerned educational technology research previous to the dawn of the internet age? In the 1970s, new technology created or exposed insufficiencies in established theories and models. In response, researchers challenged those theories and models. In the 1980s, much of the dialogue of educational technology centered on the behaviorism/cognitivism debate. In the 1990s, both Ertmer (1999) and Kozma (1994) urged faster implementation of technology while Clark (1994) and Johnstone (1991) warned against overenthusiasm for technology. Clark (1994) and Kozma (1994) also disagreed about the role of media in learning.

Based on the 20 most cited articles from the 1990s, there is no reason to believe that every practitioner and researcher in the field of educational technology achieved intellectual harmony regarding these debates. However, enough theoretical foundation had been built by 2000 that researchers could at least clearly communicate about their theoretical differences. Perhaps this explains why research began to trend away from theoretical papers. Beginning with papers published in 2000, we saw a trend of researchers asking whether practitioner beliefs are aligned with practice. For instance, Ertmer (2005) investigated whether there was a gap between teacher practice and the theoretical framework (like constructivism) that the teachers aligned themselves with. It appears that by the 2000s, the theoretical roots of the field had matured enough to accommodate new types of discussions.

Future Trajectory and Conclusions

In the 1980s, the knitting together of previously disparate fields created theoretical tension that had a major impact on the field of educational technology that lasted for at least 20 years. Perhaps this indicates that if cross-disciplinary discussions once again becomes central to educational technology research, then the theoretical foundations of the field may undergo another seismic shift. Or perhaps cross-disciplinary research would instead result in the formation of sub-fields. It may be that only a dramatic evolution of technology on par with the invention of the internet would result in a similarly dramatic evolution of the field of educational technology.

It seems that a natural course for educational technology research is for researchers to (a) solidify their theoretical base, (b) determine the affordances of a technology, and (c) investigate pedagogical strategies related to that technology. In 2020, many of the studies that used familiar technology were focused on pedagogy. However, the AR/VR research was meant to determine the affordances of AR/VR. Once it is clear what the affordances of AR/VR are, we would expect to see pedagogy-related research in this area.

We have speculated about why, starting in the 2000s, theoretical papers stopped having such an impact on the field, but we recommend a more thorough investigation of this topic. We also recommend continued bibliometric studies similar to ours that synthesize decades of educational technology research into a holistic picture of the field (perhaps from 2020 to 2070). As research continues, we anticipate further expansion in the field of educational technology.

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"I Can Do Things Because I Feel Valuable"

Authentic Project Experiences and How They Matter to Instructional Design Students

Jason K. McDonald & Amy A. Rogers

Design

Open

Participation

Instructional Design

Education

Case Study

Mentor

Data

Instructional Design Education

Matter

Project

This paper examines how authentic project experiences matter to instructional design students. We explored this through a single case study of an instructional design student (referred to as Abby) who participated as a member of an educational simulation design team at a university in the western United States. Our data consisted of interviews with Abby that we analyzed to understand how she depicted her participation in this authentic project. In general, Abby found her project involvement to open up both possibilities and constraints. Early in her involvement, when she encountered limitations she did not expect, those constraints showed up as most significant and she saw the project as a place of disenfranchisement that highlighted her inadequacies. Later, in conjunction with changes in the project structure and help from a supportive mentor, she reoriented to the possibilities her participation made available, all of which disrupted the cycle of disenfranchisement in which she seemed to be caught. Abby saw more clearly opportunities that had previously been obscured, and she became one of the project's valued leaders. We conclude by discussing implications of these findings for understanding how authentic project experiences can fit into instructional design education.

Introduction

Our purpose in this paper is to explore authentic project experiences in instructional design education. As Lowell and Moore (2020) summarized, such experiences are meant to help students “hit the ground running” (p. 581), preparing them for the rigors of professional practice upon completion of their academic training. Prior research has pointed towards a number of benefits they can have to accomplish this purpose. Studies indicate authentic projects help bridge the gap between classroom and workplace as they provide natural interactions between students and professional colleagues (Kramer-Simpson et al., 2015), expose students to the constraints and challenges of work settings (Herrington et al., 2003), and present opportunities to practice design in potentially demanding circumstances (Miller & Grooms, 2018).

Our interest in authentic project experiences centers on how they matter to instructional design students as part of their education. But whereas prior studies—both within instructional design and in other fields—have researched student perspectives to develop insights into what they think about authentic projects (Dabbagh & Williams Blijd, 2010; Hynie et al., 2011; Miller & Grooms, 2018; Vo et al., 2018), our concern was somewhat different. We studied the issue from a practice-oriented point-of-view (Nicolini, 2012), attending to different modes of engagement that are opened up to students through authentic project participation, including how students fit into project environments and what can be learned about how projects matter by depicting this fit qualitatively. To explore this in richness and depth, we carried out a single case study of a student involved in an authentic project at the culmination of her Master’s program in instructional design. Our inquiry focused on three questions: How did the student’s authentic project participation matter to her? How did her project involvement fit into her education? And what can be learned about student involvement in authentic instructional design projects by studying this fit?

Literature Review

The expectations that clients, team members, and other stakeholders have about what instructional designers do can lead to challenges for novices in the field. Instructional design is a complex profession, requiring designers to cope with uncertainty (Ertmer et al., 2008), make frequent judgments (Gray et al., 2015), and adapt formal models or theories into practical action, with little time for reflection (Ertmer et al., 2009; Yanchar et al., 2010). All of these can be difficult for new practitioners to manage, leading to work-related stress (Fortney & Yamagata-Lynch, 2013), and requiring employers to invest in on-the-job assistance (Stefaniak, 2017). The role of an instructional designer can also be very ambiguous, leading to additional stress if designers’ expectations of their role are misaligned with those with whom they work (Drysdale, 2019; Radhakrishnan, 2018). In addition, instructional designers are often expected to be proficient in a wide range of skills that go beyond the actual design of instruction, including project management, building professional relationships, responding to shifting priorities, and promoting or defending their role to colleagues (Schwier & Wilson, 2010).

These needs have led to calls for more authentic experiences to be integrated into instructional design education, as a means for preparing students for the rigors of professional practice (Bannan-Ritland, 2001; Larson & Lockee, 2009; Lowell & Moore, 2020). Long a part of learning in many fields, authentic project experiences can vary in scope, ranging from class assignments based on true-to-life scenarios (Herrington et al., 2003), to working on client projects as part of coursework (Lowell & Moore, 2020), to internships where students work for an extended period of time and with at least some degree of autonomy (Johari & Bradshaw, 2008). They can be primarily teacher-directed, student-directed, or exhibit a mix of oversight methods (Aadland & Aabo, 2020).

Regardless of scale or the name by which they go, however, authentic project experiences share at least some commitment to a learn-by-doing philosophy, as described in theories of experiential learning (Kolb, 1984). Their benefit is often framed in the opportunities they give students to practice design in real circumstances (Miller & Grooms, 2018), or at least circumstances that closely model real situations (Herrington et al., 2003). They allow students to collaborate

with clients and disciplinary specialists (Kramer-Simpson et al., 2015; Lei & Yin, 2019), often exposing them to constraints they might face in on-the-job settings (Herrington et al., 2003). Projects can help students develop specific skills they will need upon entering the workforce, such as leadership and communication (Hynie et al., 2011). In many ways, the value of authentic experiences is the balance they provide between offering students a “dose of reality” about professional practice (Hartt & Rossett, 2000, p. 41), while at the same time being a reasonably safe environment where they can reflect on, and learn from, failures they might experience (Kramer-Simpson et al., 2015).

Research indicates there can be challenges with authentic project experiences, however. Especially in their more unstructured forms they likely require effective mentorship on the part of instructors or other experts to help students translate the experience into productive growth (Heinrich & Green, 2020; Johari & Bradshaw, 2008). Also, if the project is significantly beyond students’ skills, they might not provide a sufficient return on investment to the person or organization providing the experience (Hartt & Rossett, 2000). The value of authentic projects can also be limited if students are not willing to fully immerse themselves in the learning task, especially those that might be structured around more simulated scenarios (Herrington et al., 2003). And students might have expectations about the experience that are unmet—such as the nature of the work they will be doing, their role on the team, or how effective the experience will be—leading to frustration or disillusionment (Dabbagh & Williams Blijd, 2010).

To address these possible shortcomings, scholars have studied authentic project experiences in instructional design education from a variety of perspectives. Some research has been more conceptual, such as Bannan-Ritland’s (2001) review of what she called the principles of “action learning” (p. 37), which she illustrated by describing examples of how authentic project experiences can align with those principles. This type of research also includes Miller and Groom’s (2018) articulation of a framework for integrating authentic projects into instructional design curricula. Other researchers have focused on the varying perceptions of those participating in authentic projects. Dabbagh and Williams Blijd (2010) found that students generally viewed authentic projects as a positive contribution towards their education, in spite of moments of “anxiety and confusion” that often accompanied their immersion in the project environment (p. 6). From another angle, Hartt and Rossett (2000) focused on the perspective of those providing authentic project experiences. They studied to what extent students’ work provided a return on their organizational investment, and found that in many cases students provided meaningful value and the overall experience was positive for the organization. Finally, other researchers have focused on guidelines for designing particular types of authentic projects, such as Stefaniak’s (2015) focus on service-learning experiences, Johari and Bradshaw’s (2008) study of project-based learning in internship programs, and Lowell and Moore’s (2020) exploration of authentic projects in online environments.

Our study aims to contribute towards this body of literature, focusing on authentic project experiences as a rich phenomenon that can reveal unique insights when examined from the perspective of the “concernful involvement” of students participating in projects (Yanchar, 2015, p. 110). We did not solely focus on what authentic projects accomplish from an external point-of-view, such as the educational outcomes instructors might want them to provide. Nor did we focus only on the subjective perspectives that students might have about authentic projects. Instead, we studied how students were involved in, and engaged with, project work from a practice-oriented perspective (Nicolini, 2012), to more fully understand how authentic projects matter to students as seen through their responses to project experiences. This can generate knowledge about the nature of student involvement in authentic projects as well as how authentic projects fit into instructional design education more generally (Yanchar & Slife, 2017).

Method

To address our research questions we chose a case study methodology. Our case is that of an instructional design student involved with a team-based project, designing simulations to teach cybersecurity at both the high school and college level. Throughout our report we will refer to her as Abby. We chose a case study because it would allow us to explore Abby’s practical involvement with this authentic project in detail, providing insight into her participation by taking the world seriously as she experienced it (Packer, 2018). Our purpose was not to test a hypothesis about authentic projects, nor to generate universal laws or principles about how they fit into instructional design education. We also did not attempt to evaluate the effectiveness of the team with which Abby participated. Rather, we aimed to

understand authentic projects in a new, and perhaps unfamiliar way, as we became attuned to the details of Abby's experience over the course of about a year. We were also interested in the discriminations she made in response to project-related events, including her affective responses to both positive and negative situations. This type of research allows readers to become "affectively reoriented to the world," meaning "that we think differently about the world, . . . that we feel it differently, [and] see it differently" (Wrathall, 2011, p. 170). Throughout our research we assumed a view of people and their practical involvement as found in the writings of Dreyfus (1991), Packer (2018), and Yanchar and Slife (2017), based in the philosophy of thinkers such as Heidegger (1962) and Merleau-Ponty (1964). In this perspective, "humans are fully embodied, engaged agents . . . situated in a lived world of significance," which allows for theorizing into human activity that does not "invoke a more fundamental reality of causal forces assumed to control . . . human participation" (Yanchar & Slife, 2017, pp. 147–148).

The context of Abby's involvement with this instructional design team was grounded in her pursuit of a Master's degree in instructional design from an R2 university in the western United States. This university enrolled about 34,000 students (31,000 undergraduates and 3,000 graduate students), and employed over 1,000 full-time, tenure-track faculty. The team included members from all of these groups – professors (including this paper's first author), undergraduate, and graduate students, from the fields of instructional design, information technology, and creative writing. The professors were supported by grants they had received to study simulations in cybersecurity education, including a large NSF grant. All of the students were part-time employees. Abby, who had been a member of the team for about 12 months, was involved for at least three additional reasons: the project fulfilled an internship requirement for her Master's degree in instructional design; she was using the project as the site of her thesis research; and the project gave her opportunities to complete various assignments for classes in which she was enrolled. According to Aadland and Aaboens's (2020) taxonomy, Abby's involvement would be characterized as student-directed. She was primarily responsible for ensuring her participation met her educational goals, and her work was not specifically designed to serve her needs. While Abby did receive oversight from professors associated with the project they did so in their capacity as project supervisors and not as her teachers.

Our data were drawn from our multi-year, in-depth study of the team with which Abby was involved. Our full corpus of data consisted of interviews with team members, transcripts of team meetings, field notes generated by researchers, and artifacts the team produced during the course of their work. From this data we segmented out observations and interviews in which Abby participated over the course of approximately one year, along with related field notes produced by the researchers during the same period. The researchers observed Abby in team meetings held every 1 – 2 weeks, and the first author conducted discussions with her every 2 – 3 weeks. Some conversations lasted a few minutes while others were an hour or more. The specific quotes we use in our report to illustrate Abby's involvement with the project were drawn from two formal interviews the first author conducted with her towards the end of the study, each lasting approximately 45 minutes. These interviews were audio recorded, then transcribed for analysis.

Our analysis method was drawn from Packer (2018). Packer's approach relies on careful analysis of the words and other linguistic conventions research participants use to relate their experiences. The goal is not to summarize people's experiences into a set of codes or otherwise abstract expressions that can be generalized across situations. In contrast, his method is meant to generate an empirically based interpretation of the local, practical work in which people engage to account for themselves and their situation. The results of such an analysis are typically ethnographic in character, although they are not full ethnographies since they are centered around participants' self-reports rather than including observations or artifact analysis. There are reports that Packer called, "a way of seeing the world that follows from [interview participants'] way of being in the world" (p. 472). Further, it is often the case that the usefulness of these studies is at least partially found in their uniqueness. Rather than being valuable because they are universal, such research is meant to provide a distinctive vantage point from which to view a phenomenon—a view that can reveal fresh insights about common things.

To achieve this outcome we conducted a hermeneutic analysis based on close readings of our data. This analysis centered around the effects Abby's interviews had on our understanding of her project experience (Packer, 2018). We started by articulating our initial understanding of each transcript (done individually by each author and then in

discussion together). We then engaged in the following steps recommended by Packer, focusing not on any inherent meaning in the words of the transcript but attempting to articulate the effects they had on our understanding. In each transcript we identified: (a) the context of the interview – its background, purpose, and facts it contained about Abby or her participation in the project; (b) gaps in Abby’s report, where she seemed to be making assumptions or taking for granted certain conclusions; (c) the tropes and structures through which Abby communicated details of her situation as well as her affective responses to her circumstances; (d) the chronology of Abby’s experience—especially breakdowns in her experience—and how she talked about herself as an agent in these events; and (e) any explicit knowledge Abby identified as important to understand her story. At each stage we recorded evidence that supported our interpretation of Abby’s claims, any disconfirming evidence or examples, the effects our readings were having on our understanding, and additional questions raised by that phase of analysis. Through hermeneutic comparison of each of these parts with the whole transcripts, as well as the whole with the individual parts (Fleming et al., 2003), we crafted an account that provided “a new way of seeing” (Packer, 2018, p. 149) the research issues of our study, while remaining true to the details of Abby’s experience.

While this method allowed for a detailed examination of Abby’s mode of engaging with the project—including her own complicity in creating that mode of engagement (Packer, 2018)—we acknowledge that it does come with some limitations. Abby’s reports undoubtedly reflected her own biases, and the project itself also afforded certain ways of participating better than others. So we recognize that other instructional design students may see and experience their authentic project experiences differently than did Abby, as well as respond to events in a different manner than she did. So our findings do not generalize to every situation educators might encounter. Nevertheless, there is still value in understanding the experiences of one student to the depth we provide here. Even single cases can uncover new possibilities or reveal uncommon or unfamiliar aspects of the world – possibilities and aspects that might remain hidden when using research methods that summarize the detail of large numbers of students (Stake, 1995). They can also suggest certain things that must be taken into account if one were to develop broader, more generalizable theories or frameworks, recognizing that if events happen even in one case they are legitimately part of the world, regardless of their frequency (Flyvbjerg, 2001). It is these types of findings that we aimed to generate through our study.

Findings

As Abby described her involvement with the simulation project, she depicted it as a place of both possibility and constraint. As she initially explored the project space she encountered considerable freedom, and she believed these opportunities would allow her to meaningfully contribute towards ensuring the simulations would achieve their intended outcomes. But then Abby encountered limitations to her participation that she did not expect. The significance of these constraints started to eclipse the opportunities she had seen, and the project started to show up to her as a place of disenfranchisement that highlighted her inadequacies. Later, in conjunction with changes in the project structure and help from a supportive mentor, Abby reoriented to the possibilities available and disrupted the cycle of disenfranchisement in which she seemed to be caught. She saw more clearly opportunities that had previously been obscured, and she became one of the project’s valued leaders. These stages are summarized in Table 1, and are further developed in the sections that follow.

Table 1

Summary of Abby’s Involvement in an Authentic Project Experience

Abby’s involvement	How Abby’s involvement was significant
Abby encountered initial freedom, with few firm expectations and many opportunities to pursue what she thought was important.	Abby believed she developed a unique point-of-view on the project that would help her make a meaningful contribution.
Abby encountered limitations; she did not have the skills to implement her ideas for improving the simulations, and	Abby felt like she had been boxed in and disenfranchised. She felt inadequate and started to pull away from full

Abby's involvement	How Abby's involvement was significant
teammates often told her that her suggestions were not the team's priorities.	participation.
Abby received help from a supportive mentor, and was given new opportunities to lead out in aspects of the project's development.	Abby reoriented towards the possibilities the project offered her; as she reengaged she became one of the project's valued leaders, seeing even more ways she could be meaningfully involved.

Abby's Initial Involvement – Few Firm Expectations and a Unique Point-Of-View

Abby's initial engagement with the team looked as if it would serve mutually beneficial purposes. From Abby's point of view, joining the project gave her an opportunity to pursue a research interest that would ultimately become her thesis – how to better attract high school girls to STEM careers. On the team's part, they wanted Abby to oversee what she called the simulations' "education-oriented" components. Her first assignment was to develop learning outcomes for each simulation. Abby was also tasked to develop teacher support materials to accompany the simulations; while students were meant to complete each one on their own (as a unit within a larger class on cybersecurity-related topics), the team wanted to provide teachers with enough support to feel confident they could answer any student questions that might arise. And finally, because Abby had some training in instructional video production, the team anticipated that she would oversee the production staff who would develop each simulation's video elements (however, this was not scheduled to begin until a few months after Abby was hired, and so it did not influence her initial participation).

As Abby's involvement with the project deepened, she became aware that the nature of her work differed from other students. While others were required to provide tangible evidence of their progress on a regular basis, Abby's responsibilities did not come with the same amount of oversight. She generally followed her own schedule, and was rarely asked to report the status of her work in the same way as others. If something was not completed on time (such as the learning outcomes for a simulation phase), the rest of the team was told to move ahead, adjusting their work when Abby was finished. Relatedly, Abby also noticed that her deliverables differed from those of other students. Their work products were almost exclusively concrete – written narrative elements, files for UX elements, or code to run the simulation. Abby, in contrast, while producing a few tangible artifacts (e.g., worksheets for teachers), found most of her work to be conceptual, such as writing learning outcomes that might influence the form the narrative or user interface took, but that did not show up in the simulations directly.

Together, these conditions created an environment where Abby initially felt free to pursue whatever work she thought best. She said that she felt "less tethered to one particular expertise," and although she was assigned certain tasks she did not feel bound to any certain process for completing them, nor did she limit her involvement to only those areas to which she was formally assigned. For example, she took it upon herself to complete one of the simulations on her own, from start to finish without the answer key – something no one else on the team had done. She told us this was because "I'm more responsible for what the student experience is like," and "I feel like it's my job to make sure that the students have the scaffolding that they need, that they're accomplishing the tasks, [and] that the tasks are meaningful," even though no one told her so explicitly. Additionally, Abby assumed responsibility for evaluating the simulations' usability. She told us that watching students actually using them helped her generate insights for improving the team's work. From her observations, Abby "could tell... if they thought [a simulation] was strange, or it rubbed them the wrong way." She also observed what she called students' "emotional reactions" to their experience, "if [this student] liked it or [another] didn't," that further informed her view of the project. Helping professors with their research into the simulations helped her develop additional ideas for improving them, as well.

Abby told us she initially believed that because these assigned and assumed responsibilities were unique compared to what her teammates were doing, she developed a "different perspective," regarding how to design the simulations so they would achieve their intended outcomes. She saw a "vision" of the project that was not "necessarily easy for everyone to see." She told us that, "because I've been involved in the research . . . and, like, going through it in classes,

and trying to really understand the students' experience, I think I'm more connected with that aspect." She identified this as a distinct opportunity she had to contribute to the project team, "conveying that vision," as she called it, and sharing her unique outlook with others – one that they were not in a position to see on their own.

Abby Encounters Limitations to Her Involvement

As Abby became more involved with the team, however, she told us that her working environment began to show up as more and more limiting, and that the project started to feel like a place of constraint. She slipped into a pattern of yielding to others to shape the simulations' direction, and eventually saw fewer opportunities to act on her own. As we undertake to describe this, we recognize the potential irony – one might think the environment Abby initially described, where she was largely able to decide when and how she would engage, and where she was bringing unique insights back to the team, would be a space of accomplishment. But in actuality she began to depict her participation as characterized by constraints and limits. As we will show later, Abby was eventually able to reorient and reengage with the project in a more freeing manner, but at least for a time nearly the opposite occurred, and she talked about herself as if she had been boxed in by obstacles that had been placed around her.

Yet this was not merely her private interpretation of the situation that she was able to overcome only by adopting a better attitude towards what seemed to be constraining forces. Rather, the project itself had real features that afforded themselves towards courses of action that were more limiting than freeing. As Abby pursued these she did so as if she were taking a path of least resistance – a path that, although it was the easiest, was nevertheless one that she moved into (although she avoided admitting that to herself at the time). Correspondingly, when we later describe the positive changes in Abby's participation, we will show that while it was true that it did include a change in how she approached her circumstances, it also reflected a change in the project structure so that it afforded itself towards more liberating possibilities on Abby's part. So we are careful not to portray Abby as either choosing on her own to see the project as a confined space, or as being forced into a constrained role by deterministic, environmental forces outside of her control. Abby's interviews invited us to see how the way she fit within the project's structure made it easy for limitations to show up as relevant, while at the same time recognizing that the concrete ways those limitations mattered to her, and how she chose to cope with them, were equally important in defining her experience.

Being Boxed In

Abby told us about two, interrelated factors that together showed the project as a space where she was boxed in, with limited options to meaningfully participate. First, as noted earlier, there was a contrast between the nature of Abby's work and that of her teammates. Abby told us that others offered what she called "tangible" contributions towards the simulation's final form – the form students would actually experience. This included the simulations' code, the graphic design that gave them visual representation, and the creative writing that brought each simulation's story to life. Abby, on the other hand, defined her contribution as, "helping people do what they need to do." She seemed to draw a distinction between the work others did—creating the concrete and visible building blocks that one could point to in the final simulation—and the work she did, which was conceptual, in the background, and useful to the extent that it helped the rest of the team do their jobs better.

While in the abstract Abby talked about such contributions as having "value," actual examples she shared reflected a more conflicted tone, because most of her ideas required someone else to actually give them a perceptible form. For instance, she told us that she accepted responsibility for whether students were successful in learning from the simulations, "if people are experiencing [poor learning outcomes], then I would maybe feel, like, maybe that's on me." But she also said she had not created anything that students would encounter directly to help them achieve those outcomes, nor did she have the ability to do so. "People aren't going to be, like, 'oh, Abby built this or did this.' . . . I'm not doing anything right now that's going to be a tangible thing." The nature of Abby's involvement meant that without help from her colleagues, what she designed would not be used by students. And it seemed this began to overshadow the importance of any concrete materials she was producing, such as her teacher support materials. After initially describing that she was working on them, and while we know from our observations that she completed the

assignment, she did not bring them up again and did not mention deriving any satisfaction or sense of significance from their completion.

Alone this may not have meant much to Abby, other than occasional hints she offered about how she would have enjoyed the recognition that accompanied the simulation's concrete development. But Abby also found that her teammates could be reluctant to accept or implement any suggestions she provided. Through her research, usability testing, and personal experience completing them, she generated a number of ideas for how the simulations could be improved. And at least for a time she would bring her ideas back to the rest of the team. But often their response was her suggestions were either too difficult or were not their current priority:

I'm, like, "hey, I really think we should change this." And I feel, like, sometimes people are, like, "that's kind of hard and we don't necessarily want to do it." So then that value doesn't necessarily come to fruition.

Abby offered multiple examples. A particularly illustrative one concerned the team's focus on building women's self-efficacy to pursue a cybersecurity career:

I really feel like putting students' names in [the simulation] would be really helpful. We've used Junior because that's just an easy way to program it. And that rubbed me the wrong way when I got on, especially thinking if we're trying to target girls. Like, so, here's me putting my researcher hat on. I know we want to help girls feel more, like, identify with this better. And I'm thinking, no girl has ever been called Junior as a nickname. . . . I tried it out with my sister, and my sister's, like, "Junior, what, is that me?" So, I can hear this from the students. I'm thinking from my research mind, "this is not good." I talked to [the lead professor], he's, like, "oh, yeah, students identify better if their name is there." Then when I take that to the team, they're, like, "oh, that's going to be a lot of work." So, how much do I push it?

The result of dismissals such as these was a growing sense on Abby's part that what she wanted to contribute was not as needed as what her team members offered. Not only did it appear that they valued different outcomes than her, but she also concluded that she did not have the ability to influence the direction the simulations would take, "I've kind of let the developers do their thing . . . I didn't see myself to be in a position to tell them anything." She often described the simulations' development as occurring around her, where she was aware of what was happening, but they were not something she was directly helping. Over time, she saw fewer opportunities to engage in ways that would change the project's trajectory, including changes aligned with what she learned through her research into the simulations' educational effectiveness.

Growing Disenfranchisement

Given that Abby needed cooperation from her teammates to implement her designs, their dismissals hurt her deeply, "why be on a team if you're not doing anything? So, it kind of made me—if I'm not really doing much, then I just kind of feel pointless. Well, maybe I shouldn't be here." We use the term hurt intentionally. Similar to how a physical injury can become inflamed and sensitive, and the afflicted area becomes too tender to tolerate an otherwise benign touch, or bear what would otherwise be one's ordinary weight, Abby's growing sensitivity to her limitations led her to pull away from other team members to avoid difficult interactions. She particularly became attuned to, and even defensive about, potential offenses on the part of her teammates (whether intended or not).

One example occurred when new writers were hired to complete the simulation narrative. Abby told us that as they were beginning their work she tried to show them a set of scripts she had consulted on with the previous writers:

I was trying to point out, "hey, look, we did a lot of work on this last spring. We might want to look in this folder because somebody already wrote a bunch of scripts. We don't need to reinvent the wheel." And [one of the writers] told me, "well, yeah, but we're master's students, and so we probably can do a better job."

Abby continued, "that response just felt like it was dismissing what I was trying to say. So, instead of listening and validating. . . like, 'tell me more,' it was just dismissing." Abby told us that by this she meant that she thought the writers were both dismissive of the work that had been done as well as of her attempts to have a conversation about it.

Additionally, she was particularly bothered that at least one writer did not seem to understand that she was also a graduate student, “[the writer said], ‘well, I’m a master’s student.’ Okay. So am I, but I won’t mention that.” Abby found the experience quite disheartening, telling us, “I was so frustrated,” and describing how afterwards she started to withdraw from fully participating. At one point she told us that her response was, “all right, I’ll step aside.” At another time she described it as, “okay, I’ll back out of your way.” Both phrases seemed to suggest Abby’s sense of resignation and defeat.

In talking about incidents like these, Abby seemed to describe the project as being a place of disenfranchisement, depriving her of opportunities to offer meaningful contributions, and where she had been judged as inadequate to contribute anything of substance. The positive aspects of her participation, which earlier had seemed so fulfilling, receded into the background. She started to primarily focus on her limitations, even going so far as to tell us, “I didn’t really feel like I had anything that I was doing. . . [For a semester] I was hardly assigned anything. Yeah, I was like a bump on a log.”

As we analyzed other events Abby talked about, however, we saw that while it was true that her contributions could be discounted, at the same time she started to pull away from the project as well. This also reduced the extent to which she was actively involved. In the face of rejection it seemed that Abby generally stopped putting herself in the position of being rejected again. At one point she even seemed to openly admit this, saying, “[I] was, like, not super engaged in what was going on.” She described one instance, during the time she was “frustrated that no one was valuing what had been done last spring” (meaning when the new writers had abandoned the existing scripts). One of the professors asked Abby to work with the same writer who had been particularly dismissive to update some of the material students would initially encounter when using a simulation. Abby described this as another case of work she had previously completed being dismissed without actually examining what had been done, “I was like, ‘it’s all there, we did this, look at this.’” In response to the request, Abby told us that, “I refused to help. And so instead of being involved, I just, like, checked out.” Out of these difficult interactions a vicious circle seemed to emerge. Abby thought her contributions were being rebuffed, and she responded by pulling away. But this meant she had fewer opportunities for meaningful involvement, which further darkened her mood. As she became more discouraged, the actions of her teammates tended to show up as if they were intentionally slighting her work. Whether they actually were or not, the result was the same; Abby became sensitive (or perhaps overly sensitive) to saliences that appeared slighting, which, in turn, fueled a further sense on her part that she was not needed.

Interestingly, even though Abby told us that for a semester she “was hardly assigned to anything,” based on team meetings we observed during that period this appears to have not actually been the case. We watched Abby participating in project decisions, taking assignments, and being treated by others as a full contributor to the project. Yet we do not interpret Abby’s insistence that she had nothing to do as her trying to mislead us, or that her memory was flawed (although we acknowledge both of these as possibilities). Rather, since when she was not talking about her disenfranchisement she occasionally brought up other ways she was involved during this same period, it seems more likely that when she talked about not being assigned anything she was trying to communicate the affective quality of her experience instead of the literal facts of the situation. Saying that she was, “a bump on a log,” or that, “[I] didn’t really feel like I had anything I was doing,” were her attempts to point out what was significant about her circumstances. What seemed to matter most was that she saw herself as not being a contributor, and that she did not see the simulations being improved because of her work. Yet, as we have emphasized, this sense was not solely created by either the events around her, or by her beliefs and attitudes about those events. It seems to be better characterized as a way of engagement that was jointly produced both by the situation Abby found herself in as well as how she attempted to cope with what she experienced.

Abby Moves from Disenfranchisement to Valued Project Leader

Despite her growing discouragement, Abby did not completely abandon her membership on the team. When we asked why she identified at least three aspects that continued to draw her in. First, notwithstanding the difficult interactions Abby had with some teammates, others had become her friends, and she described a “connection with certain people I was working with” that she wanted to maintain. She also seemed to fall into something of a sunk cost fallacy, telling us,

"I was involved when it started. . . I guess I felt some level of investment and commitment." Finally, she would reminisce about the sense of belonging and being a contributor she once experienced, and hoped that she could recapture it in some form, "we were excited about this idea that we [came] up with. . . . So I guess I cared about being on the team and I wanted to be productive and useful." These largely emotional factors—all mattering to Abby in different ways and providing her different motives for wanting to participate—were significant enough to tether her to the project even as so many other aspects continued to push her away.

Alone, however, these commitments did not actually change anything in Abby's situation. While they inclined her towards at least some association with the team, she still remained mostly disengaged until three, somewhat intertwined features of the project structure also changed, that together seemed to open up possibilities that Abby found less constraining. The first was that a certain professor who was sensitive to helping students have good experiences began to assume a more prominent role as the team began working on a simulation for which he was the subject matter expert (we will refer to him as Eric). Abby told us that Eric "makes [her] feel valued," and, "he just totally built me up." The second factor was Abby enrolled in a project management class that required her to be a "scrum master" for a product team (a project management role found in agile approaches to product development). Abby asked Eric if he would allow her to complete her assignment for the simulation he was overseeing, "I need this experience, so I emailed Eric, like, 'hey, do you think I could be scrum master on our team?'" Eric's response was, to Abby, very enthusiastic, "immediately he started referring to me as the scrum master." She further commented, "he'd, like, let me lead in meetings," and, "the way Eric is, like, promoting me and what I can do, I think I [now] have more of a leadership role." Finally, development reached the point that video production began, and Abby said she also felt valued because, "[team leaders] put me in charge of the videos and actually said, 'Abby's responsible for this,' and, 'go to Abby.'"

As Abby pursued the new assignments and opportunities these structural changes opened up, the character of her participation changed as well, reorienting from a sense of disengagement to one of more complete involvement. She became more attuned to possibilities in her situation, as suggested by her comment that, "I can do things because I feel valuable." To illustrate she provided a number of examples of not only the new work she was doing but also the change she experienced in the character and quality of her participation.

One change was that even though the work Abby did during this period continued to be intangible and largely in the service of teammates doing concrete production, she began to describe it as adding value, as opposed to her previous sense that her work was not needed. For instance, even though Abby did not produce the simulation videos herself, she did take the initiative to recruit, hire, and support the videographer with little oversight or direction from those supervising her. Of this she said:

I think we're all excited about the videos right now because we have [our videographer], who's, like, our – he's going to make it cool. He's going to make it cool. We have actors that we're excited about . . . [The videographer] interviewed them and sent me the videos and all these people are going to be so fun. . . . So, I think I'm excited about the production, and we're shooting on Saturday, so it's like the big thing right now.

The difference in Abby's tone as she described her support of the videos was striking. Whereas her comments about previous events could reflect a sense of despondency, when she described her leadership over the video production—even though she was not directly shooting the videos herself—she spoke with a sense of enthusiasm that suggested she was more confident about her place on the team than she felt before.

A related change was that difficult interactions with teammates that had previously bothered her so much, seemed to recede into the background of her experience. She told us, "now I feel a lot more respected and capable and less impacted by those types of situations. So, I'm not as worried about that now." Even though she told us there were still hard conversations or challenging problems to address, her sensitivity to them diminished, and she talked about them more dispassionately than she had before.

And finally, as Abby began acting as the scrum master she started to see things about the project she had not noticed earlier. In particular, her experience of being disenfranchised no longer appeared to be so unique. She started to get a

sense that the overall project had been “stuck.” She told us, “there hasn’t been a whole lot of organization in getting stuff done,” and seemed to indicate that from the perspective of her new role she could see that she had not been the only person frustrated because they felt like they were not contributing, or that what they were doing did not matter. But realizing this did not lead to her to slip back into discouragement. Rather, she seemed more attuned to situational possibilities for how she could lead out and help the team make better progress, like enforcing daily status updates, planning agendas for project meetings, or contributing new design ideas that could create additional project momentum.

By the time of our final discussions with Abby she appeared to have largely overcome any sense that the project was boxing her in. Neither was she as discouraged as she had been earlier. But she did not just perceive different things about the simulations, her teammates, or her own work. She was involved in the project in a completely different way, more as a valued leader than as an occasional contributor. This does not mean the project has become trouble-free. As mentioned, after being placed in a leadership role Abby could see project shortcomings she had not seen before, and even while we were interviewing her she had questions about whether the simulations were as effective as they could be at achieving their outcomes. But Abby seemed to approach these challenges from a position of self-possession, rather than disenfranchisement or doubt. She became a leader not only because she had skills to help her lead, but because she started to respond to circumstances like leaders respond, as suggested by her comment:

I’m involved in lots of aspects of lots of things. . . . When things are brought up [I think], “oh, yes, I have something that I want to bring up for the team to think about.” . . . I have more to contribute because I’m more involved.

As we have emphasized, this seemed to be due to opportunities Abby was given as well as her own willingness to accept those opportunities and make something of them. Whereas before she experienced a vicious circle of further and further disengagement, she now seemed caught up in a virtuous circle. Others’ willingness to believe in her and give her new ways to contribute opened a space for her to act. Accepting what they offered reignited her enthusiasm, and her improved mood showed her even more opportunities for involvement. Abby herself seemed to recognize the change, telling us, “there’s just been a huge contrast” between times that she was so hurt by actions of her teammates that she was willing to step away from active participation, to the time of our interviews where she was being told by her colleagues, “Abby’s so important on this team, Abby’s involved, Abby does everything, Abby does more than the professors.” When we shared that this was also reflected in our own interviews with other team members, and that they were equally telling us how much she was contributing, her response was, “wow, that’s, wow. That makes me feel like I want to do even more!”

Discussion

Our interest in studying Abby’s case was to explore how her authentic project involvement mattered in her instructional design education. Analyzing her interviews provided us “a fresh way of seeing” (Packer, 2018, p. 148) what it could entail to be a student involved in this form of learning, which we summarize as three insights. First, Abby’s account contributes towards the literature recognizing that even though authentic project experiences can have clear advantages, they also may not always be unambiguous goods in students’ education. Second, we suggest that a reason for this is because the outcomes of authentic project experiences do not solely lie in any intrinsic properties of the opportunities themselves, nor in students’ personal attempts to make meaning out of those opportunities. Avoiding a dichotomous distinction between situation and student provides a clearer view of how authentic projects become a learning space when students engage in the practical work of fitting themselves to the affordances such experiences offer. Finally, we learn from Abby’s case that challenges accompanying authentic project experiences can be mitigated, but doing so will likely involve cooperation from those with the ability to adjust the form and structure of an experience, as well as the participating students themselves.

Authentic Project Experiences May Not Always Be a Pedagogical Good

For Abby, participating in the simulation project allowed her to apply a variety of skills in authentic settings and offered her unanticipated leadership opportunities, but also challenged her self-confidence to the extent that she nearly abandoned her involvement. This duality suggests there can be tensions in authentic project experiences as a pedagogical strategy, and they may not always be unambiguous goods in students' education. This aligns with findings from prior research. While researchers have described a number of benefits these experiences can provide (Johari & Bradshaw, 2008; Miller & Grooms, 2018), the literature also recognizes that the very authenticity of these experiences can create complexities with which students may have a difficult time coping (Dabbagh & Williams Blijd, 2010; Hartt & Rossett, 2000). They may find themselves tangled up in binds they do not yet have the ability to unravel on their own.

Our study extends this literature, not only by drawing attention to the forms potential complexities could take, but also by showing at least some ways that students might affectively respond if complications arise. Highlighting both potentialities seem important to help educators address challenges they might face when implementing authentic project strategies themselves. For instance, one reason project involvement was not an unambiguous good for Abby was because when her teammates were reluctant to implement her ideas, their dismissals showed up to her as obstructing her ability to meaningfully contribute. But while her views were certainly understandable, they were also not unavoidable. We can imagine how it may not have mattered as much to other students if they were challenged as Abby was, or how they might even have been energized by the need to find ways to better persuade their colleagues. So in her case, for educators to understand how to help Abby have a better experience they would have to pay attention to the situational affordances as well as the relevance of those affordances to her. Yet we are aware that Abby's experience only highlights some of the difficulties that might create strains for students involved in authentic projects. So we encourage continued research into other possibilities authentic project experiences might open up, especially research that explores challenges that can accompany the approach.

Authentic Projects Become Learning Experiences Through a Reciprocal Relationship Between Student and the Project World

As just mentioned, and as we have described throughout our report, Abby's experience was born out of real situational affordances, as well as how she negotiated and navigated those affordances. This seemed typified by how she described how her mode of engagement changed after Eric appointed her scrum master, "I can do things because I feel valuable." In Abby's world, she not only felt more or less valued based on what she was able to do, but she also felt more or less capable of acting depending on how valuable she felt. Her experience seemed characterized by reciprocity. She had to respond to features of the environment outside of her control, but her responses altered the project context and changed what type of involvement was available to her moving forward. Focusing only on one side or the other—opportunity or Abby's attitude—seems insufficient to understand either Abby or the project itself. What transpired cannot be reduced either to the influence of environmental forces acting upon her, or her private processes of constructing meaning out of her experience (see Wrathall, 2004). It seems more accurate to attempt to unify what was provided from both Abby and from the project space, "not [as] sharply distinct, self-sufficient states or separately existing ingredients, but [as] essentially interwoven aspects of a single, unified phenomenon. . . More like two sides of a coin or two dimensions of a figure" (Carman, 2020, p. 77).

Recognizing this provides a more comprehensive way of understanding authentic projects as learning experiences. Abby's account indicates that neither a view of learning that locates it primarily in environmental influences or one locating it primarily in individual processes of meaning-making is sufficient. For instance, while she clearly had to respond to environmental factors in her journey towards becoming a project leader, Abby cannot be portrayed as someone who learned leadership only because her actions came into alignment with a set of standards or norms provided by her environment – a view implied by theories that define learning as the result of processes of socialization and enculturation (cf. Matthews, 2016). And while she clearly had to interpret her situation and decide what events meant to her, she also cannot be portrayed as having learned leadership only because of personal, internal changes to her knowledge, attitudes, beliefs, or skills. Equally important were the changes to what Yanchar et al. (2013) called her "embodied familiarization" (p. 219) with the project, meaning how she was able to practically comport herself to fit into

the space provided by the real, situational demands of her work. Abby learned from her project experience as she became more capable of “meaningful engagement” with what had previously been foreign. She became more “accustomed” to, and “familiar” with, how to navigate the very practical concerns her situation required (p. 220).

This is a view that transcends reductive attempts to locate learning primarily in one type of cause or another, either cognitive or cultural. It shows learning as a process of developing a practical stance towards the world – in Abby’s case a stance taken by instructional designers. Certainly this stance includes learning new skills or developing a new identity, but is not defined by these features alone. It also includes how the world feels as one inhabits it, such as how the project felt to Abby when she was disengaged, or as she re-engaged (cf. Dreyfus, 1991). It entails how one anticipates, and becomes sensitized to, saliences in the world, such as how Abby as a project leader could see the team was not as organized as she once thought, and how this drew her attention towards opportunities that might have otherwise remained unnoticed (cf. Wrathall, 2004). It encompasses how one becomes resolved to act in response to opportunities the world offers, such as how Abby accepted the responsibility to plan project meetings so they would be a better experience for everyone involved (cf. Dreyfus, 2017). In this view, authentic projects fit into instructional design education not because they provide a single cause of learning, or even a group of causes, but because they contribute towards “shifts in how the world shows up, how learners fit into the cultural contexts of life, how they engage in practices, and the stands they take on matters of significance” (McDonald & Yanchar, 2020, p. 643).

Educators and Students Jointly Improve Authentic Project Experiences

These views suggest a new way of understanding events that might arise during students’ participation in authentic project experiences. Individual project events will not necessarily be good or bad because of any intrinsic properties they possess, because their value is at least partly found in how students respond to them. While it is true that project experiences can be well- or poorly designed, their design itself is only a starting point for the evolution of the experience that will occur as actual students get involved. But neither is it correct to say that any given event is neutral—with its learning value created by students themselves—since individual events will open up certain possibilities while at the same time closing down others. So it is still incumbent on those planning authentic experiences to “offer compelling beginnings” in projects that students “may be persuaded to pick up” as they engage in the project space (McDonald, *in press*). If authentic projects are not effective because of their inherent properties, instructional design educators and students can at least work together to make them effective by attempting to improve how students fit into them. This implies that educators may be able to help students break out of negative cycles of participation as they alter conditions in the environment and as they point students’ attention towards new possibilities that might be opened up by the improved conditions.

Prior research suggests practical ideas that educators can consider for accomplishing this, including: cultivating meaningful relationships between students and mentors so that students come to trust the guidance they provide (Michela & McDonald, 2020); ensuring the designs of project environments do not inadvertently discourage or punish students for expressing their independence (Johari & Bradshaw, 2008); providing students frequent opportunities to reflect on their experiences and whether those experiences are leading to desirable ends (Bannan-Ritland, 2001); and ensuring regular evaluation is part of authentic project environments so necessary adjustments to structures or relationships can be made (Larson & Lockee, 2009). We recommend additional research be conducted to develop other design guidelines that are consistent with our findings.

But as our study emphasizes, when challenges arise during authentic projects it is likely not the sole responsibility of any party alone to mitigate the problems – neither the educators planning the project nor the students learning from it. This is not because either side can be relieved of responsibility, but because both sides are likely contributing something towards the unfolding situation (for good or bad). Challenges may have as much to do with what stands out to students as important about their involvement as they do with any objective factors within the context itself, although situational factors would certainly contribute towards what students could see. So neither side’s efforts alone will be sufficient to alter the circumstances. On the side of the educators, while they can set up any number of conditions, they cannot set up how students respond to the conditions they provide. On the side of the students, no matter what attitude they bring into a situation, they may still find conditions that stifle their contributions or otherwise impede their capacity

to act in alignment with the practical stance the authentic project is meant to make available. So cooperation from all sides will be needed to address authentic project challenges – those with the ability to adjust the form and structure of an experience, as well as the participating students themselves. Improving the student experience will jointly be a matter of changing what opportunities the environment provides, and of students becoming reenergized as they anticipate anew the potential futures such opportunities could unfold. But educators cannot pick up the possibilities on behalf of students directly. Ultimately, as it was for Abby, students have to accept the changes they are offered, and make the project personally relevant in a manner that improves the quality and character of their participation.

Conclusion

Our purpose in this study was to explore how authentic project experiences matter to instructional design students. Through a case study of how an instructional design student, Abby, depicted her experiences as a member of a design team, we came to understand how (a) authentic projects may not always be unambiguous goods in instructional design education; (b) how this is so because authentic projects become learning experiences through a reciprocal relationship between students and the project; and (c) how because of this, educators and students must jointly cooperate in improving authentic project experiences. Of course, more research is needed to more fully understand how authentic projects matter to instructional design students. But our initial exploration here at least illuminates how part of their significance lies in the range of practical and affective responses students might have to them. We hope that further research will continue to focus on these relationships between students and the project experiences in which they participate, seeing them as important not because of what they do to students, but also because of what students are able to meaningfully contribute towards the experiences themselves.

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Implementation and Instructional Design

Brittany Eichler & Jason K. McDonald

Instructional Design

New Designs

Diffusion of Innovations

Implementation Factors

The diffusion of innovations is a process in which a product or service is implemented by an innovator. The diffusion process includes knowledge, persuasion, decision, implementation, and confirmation. The authors describe important factors of implementation using the five stages of the diffusion process: knowledge, perception, decision, and implementation. This article also reviewed characteristics of a design itself that can impact rates of adoption: relative advantage, compatibility, complexity, trialability, and observability. It is recommended that instructional designers consider the phases of innovation adoption as a framework for creating their implementation plans.

Editor's Note

This is a remixed version of an earlier chapter on [implementation in instructional design](#) that can be found at the [ADDIE Explained](#) website, and is printed here under the same license as the original.

Instruction is designed to be used. This seemingly obvious statement carries a rather significant implication: the work of an instructional designer should not end upon the final development of the product, but must include considerations for when, where, and how the instruction will be used by real learners in actual situations. This work is called implementation. It requires planning and attention to detail—the same as found throughout the rest of the instructional design process, in fact—to complete successfully. Without implementing an instructional design, all the design work would, in large measure, be wasted.

Implementation is a frequently-skipped step of the instructional design process, however. Designers are often (understandably) ready for their next exciting assignment, and often the client or other stakeholders want to be the

primary actors during implementation. The organization the designer works for may also not consider it within their scope to assign instructional designers to help in the implementation phase.

But even when someone else has the actual responsibility to implement an instructional design, the designer can (and should) still be involved, at least in some fashion. Often he or she will have information that no one else has about the design (what certain components are meant for, or how certain features behave), and that information is crucial to ensure it can be implemented successfully. Few people know the entire project as well as the designer does, and this expertise should be drawn upon during the implementation process.

The purpose of this chapter is to introduce considerations that need to be made during the implementation phase of the instructional design process. To organize our discussion we rely on the five stages of introducing a new design as described by Everett M. Rogers (2003). Additionally, it is imperative that instructional designers (or other change agents like teachers or stakeholders) are aware of how people typically use products or services as they are being implemented. So we also describe how adopters of new products or services commonly move through Rogers's stages.

Adopting New Designs

Gibbons (2013) described the importance of implementation as follows:

Implementation is a period of intense and important change. In addition, it is a period of high-stakes decisions that affect the judgment of continued use of your product. Your product is not only making its first impression on people during implementation, but it is gathering either support or censure from those most likely to determine its viability—students, instructors, and administrators. A careful implementation plan can help your product to be introduced with the best possible chances of success (p. 410).

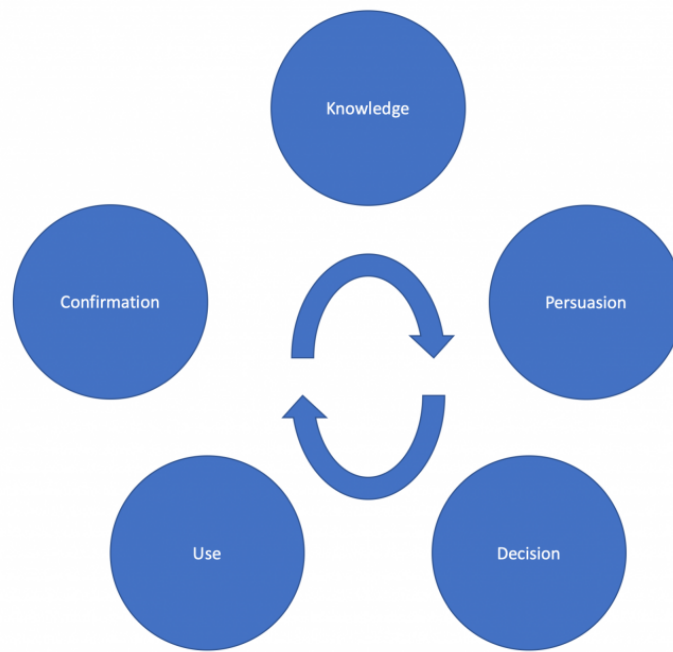
Similarly, Rogers (2003) suggested that, “the perceived newness of an innovation, and the uncertainty associated with this newness, is a distinctive aspect of innovation decision making” (p.161). As a result of this “uncertainty,” understanding the design adoption process can help designers plan an instructional design implementation to maximize the chances it can have its intended effect with learners. To help instructional designers create a complete implementation plan, we recommend considering the phases of innovation adoption as a framework for creating their implementation plans (see Figure 1). The five stages in Rogers's model that will be discussed in this chapter are:

- Knowledge
- Persuasion
- Decision
- Use
- Confirmation

Note that the stage when people actually use the new material is stage four of this model! This should be evidence of how important it is to consider many factors that affect how someone will successfully use an instructional design, and encourage designers to not just complete the project and walk away.

Figure 1

The Stages of Roger's Implementation Model



Knowledge

The expectation within the knowledge stage is that the adopter becomes aware of the design to be implemented, and determines if a need for adopting (or implementing) the design is actually present. In the context of instructional design, this could mean the designer prepares (or helps prepare) material that is useful to decision-makers about why they should use the instruction. This could take the form of an information sheet, or be more sophisticated like a full marketing campaign. It can also be directed to the students themselves, or others who might be the primary adopter of the design who will then introduce it to students (like a teacher or a school district).

Persuasion

The persuasion stage occurs when the adopter begins to decide if they find the new design acceptable. During this process, the adopter “actively seeks information about the new idea, decides what messages he or she regards as credible, and decides how he or she interprets the information that is received” (Rogers, 2003). It is through this process that an adopter begins to decide if the design will be accepted. Instructional designers can facilitate the persuasion stage at the same time they provide knowledge about it. Why is it compelling? How does it fulfill real needs? What can be said about it that adopters will feel emotionally attracted to? (Do more than just provide the facts!) Like before, persuasion can be directed to both the student or other decision-makers.

Decision

The decision stage includes the adopter actively participating in tests that will assist them in determining if the design will be adopted or rejected. It is important to note that this process can justifiably lead to either of these results: adoption or rejection. If the design is adopted, it is evidence that it is seen as a solution to the problem or issue the adopter initially defined. If the design is rejected, it can be classified as either active or passive rejection. According to Rogers (2003), active rejection consists of considering adoption of an innovation and then actively deciding not to adopt it. Passive rejection is when no identifiable decision is made, but due to inaction the innovation is effectively rejected. Instructional designers can help with the decision phase by making it as easy as possible for students or decision-makers to try out the instruction before committing to it. Can the designer be on-site for a test of the materials? Can they demonstrate to students or decision-makers what it actually looks like when the instruction is being used? Can they give away a component for free that people can test?

Use

The next stage in this model is the actual usage of the new design. Using a new product is generally not a one-time endeavor. New design usage is generally considered a long-term process. While the definition of “long-term” can be ambiguous and is heavily determined by the context, it is important to know the use of a new innovation within instructional design is usually not simply “plug and play.” There is generally a period of continued education and professional development associated with the adoption. The instructional designer might provide getting started materials so people begin using the materials successfully, or technical support to make sure problems can be solved as soon as they are apparent. They might have to train the person leading the instruction, or at the very least show students how to use all of the features found in the instruction.

As the design is implemented, it is likely that an event referred to as re-invention may occur. Re-invention is defined in this context “as the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation” (Rogers, 2003, p. 180). It is important to note that re-invention is not necessarily a negative, as it can lead to improved results. For instance, an instructional designer may have intended that students complete an online module individually, but as it begins to be used throughout a company, the employees start to gather together in groups and complete the assignments together. Even though the designer did not intend for this kind of use, evaluations could show that it is more effective—students learn more and have deeper insights as they work together. An implication of this is that designers should make their designs flexible, so they don’t break down during re-invention. They should also watch for re-invention because it might give them ideas for how they can design better in the future.

Confirmation

Confirmation occurs as the adopter evaluates the decision to adopt and implement the design. Are they satisfied with what they chose? During this stage it is possible that the design will be subsequently discontinued. The evaluation can be based on many measures: learner performance, ease of use, satisfaction, cost to maintain, etc. If discontinuance occurs, it is often a result of some kind of dissonance, or the gap adopters experience between what they expected to happen and what actually happened. It is important, then, for continued use of the design, that the instructional designer seeks methods to reduce or eliminate dissonance. Some methods to achieve reduction of elimination include helping adopters understand how to incorporate the design into their existing practices, continued support and training, and fixing problems the adopter may be experiencing with the instruction that interfere with its ability to achieve its intended outcomes.

Application Exercise

Consider an instructional design project you are either currently involved in, or one you are familiar with. Write a brief implementation plan for this project that uses all five of Rogers’s implementation phases.

Prepare a brief presentation about this implementation plan, as if you were assigned to explain to your client why each phase is important to successfully implement the project.

Attributes of Designs That Lead to Successful Implementation

In addition to the innovation-decision process, it is important for the instructional designer to consider factors in the design itself that contribute to rates of adoption. Rogers (2003) identified five such attributes: relative advantage, compatibility, complexity, trialability and observability.

Relative Advantage

The concept of relative advantage refers to whether the design is actually an improvement over the current product or service the adopter has been using. If the adopter perceives that the design’s value does not exceed that of the current

product used, the design is much less desirable and unlikely to be adopted. In contrast, a design that is determined to be of greater value is more likely to be adopted. Instructional designers should be considering the relative advantage of their instruction throughout the design process. How is what they are designing better than the status quo?

Compatibility

Compatibility is in reference to how well the design aligns with other aspects of the adopter's life and circumstances. This could include the adopter's professional, pedagogical, and sociocultural ideologies. Conflict with any of these schemas, whether directly impacting the design's actual use, could threaten adoption. As indicated by Rogers (2003), "any new idea is evaluated in comparison to existing practice. Thus compatibility is, not surprisingly, related to the rate of adoption of an innovation" (p. 249). Through careful attention to the adopter's (students or other decision-makers) beliefs, interests, needs, and concerns throughout the design process, designers can help prepare their instruction so it is more compatible with what adopters expect and need.

Complexity

Complexity is how difficult it is to comprehend, incorporate, and actually use the design. While complexity does not impact the rate of adoption to the same degree as relative advantage and compatibility, the complexity of a design can negatively impact how likely it is for adopters to use (or want to use) it. If a design is perceived to be too difficult to incorporate or use, it is less likely to be adopted in the first place or more likely to be discontinued if it is adopted. Good evaluation and testing of prototypes throughout the instructional design process can help minimize the complexity of their instruction. Designers, in fact, can consider how they can specifically test prototypes to help minimize complexity (such as through a usability test).

Trialability

Trialability refers to how readily a design can be tested or used with a limited commitment. For example, software is often introduced in stages, or "betas." These stages of progressively more complete versions of a product permit its testing on a limited basis. Such testing permits users to identify issues and helps increase adoption. Trialability has a positive impact on the rate of adoption for early adopters, but is less impactful on the rate of adoption for later adopters (Rogers, 2003). As is hopefully clear, the trialability of instruction is closely associated with the decision phase described above. Designers should prepare for the trialability of their instruction as early as possible in their design process. High fidelity prototypes might be an easy and low-cost way of doing this.

Observability

Observability refers to "the degree to which the results of an innovation are visible to others" (Rogers, 2003, p. 16). Designs that are more difficult to observe or difficult to explain and operationalize are less likely to be adopted. This can be especially difficult for instructional designers because so much of the learning process is invisible or hard to observe. It helps to make sure the learning goals of the instruction are as measurable and observable as possible. Regularly reporting the results of assessments of student learning can also help. While important, however, observability is the least impactful of the attributes Rogers identified.

Application Exercise

You are an instructional designer implementing a new computer-based learning tool in a K-12 classroom. The teacher is not technologically savvy and is hesitant to use this new tool. Explain what steps might be taken to support the teacher and mitigate their concerns.

Considering Rogers' five attributes that impact the rate of adoption of innovations, please explain how these attributes would affect implementation decisions that you, as an instructional designer, would make, for this teacher.

Conclusion

In this chapter, we discussed the implementation phase of the instructional design process. We described important factors of implementation using the five stages of the diffusion of innovations: knowledge, persuasion, decision, implementation, and confirmation. We also reviewed characteristics of a design itself that can impact rates of implementation: relative advantage, compatibility, complexity, trialability and observability.

Implementation is a phase instructional designers should begin planning for at the beginning of their project. By carefully reviewing the material we provide here, designers—and those they support—will be able to ensure the instruction they create is actually used by those it is intended for so the desired changes that led to its creation can be brought about.

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Instructional Design Prototyping Strategies

Jacquelyn Claire Johnson & Richard E. West

Instructional Design

Instructional Design Models

Prototyping

Instructional Design Practice

One of the differences between design as practiced in our field and traditional art is that our designs must not only be interesting, engaging, and even beautiful, but they must also be useful for someone—the end users or learners. Over 2,000 years ago, Marcus Vitruvius—a Roman architect—articulated that good architecture should rise to three ideals: firmitas (strength), utilitas (functionality), and venustas (beauty). In other words, a building should be strong and not fall down, it should accomplish its purpose (e.g., as a home or an office), and it should be beautiful to enjoy.

Instructional designers seek the same three ideals in our products. For us, we desire the learning environments we create to work well, teach well, and, well, be beautiful and enjoyable to experience!

Prototyping is an essential skill and process for instructional designers to achieve these three goals. Despite careful and rigorous front-end analysis, user research, and attention to detail during development, it is nearly impossible to produce instruction that works perfectly the first time. However, through iterations of prototypes, we can evaluate how well our instructional designs are working, teaching, and being enjoyed by a group of potential users. This will increase the likelihood that final designs will be successful. In addition, digital technologies have reduced the cost of creating prototypes, which has led to a new focus on agile, lean, and rapid prototyping design models where prototypes are not a single step in the process, but instead, each stage of design development can be tested as a new prototype—and this continual refinement of the design through continuous evaluation may never cease (see Wiley & Bodily's chapter in this book).

How can we effectively prototype and test our designs? We can learn much about prototyping from other design fields. For example, it is standard practice to use visual representations of ideas—such as pictures—during the creative process in many design fields such as architecture (Bilda et al., 2006), film and cinematography (Teng et al., 2014), and engineering (Perry & Sanderson, 1998). This skill is so meaningful, graphic design instructors insist that it is vital to “equip students with the ability to make well-informed decisions about tool choice and tool use during design ideation” (Stones & Cassidy, 2010, p. 439).

Though graphic design is an inherently visual field, the use of prototypes has application in other design fields as well. For instance, extensive research demonstrates the usefulness of visuals in product development as a means of exploring problems and generating possible solutions. Prototypes help designers understand specific design challenges and make inferences about the situation (Suwa & Tversky, 1997). They also contribute to many aspects of problem solving (Dorst & Cross, 2001; Do et al., 2000). Research in cognitive psychology has established that the cognitive load of processing ideas is reduced for designers through the use of visuals.

Furthermore, studies show it is easier for designers to process complex ideas with visual prototypes rather than relying on working memory (Cash, Stanković, & Štorga, 2014). Vicarious experiences can be provided through visuals, which allow designers to glean and evaluate the pertinent information without investing as much time or effort into creating the experience (Menezes & Lawson, 2006). Prototypes also can guide important design conversations “if they lead the team visually into a fruitful sequence of conversation steps” (Eppler & Kernbach, 2016, p. 96).

Key Prototyping Principles

Dam and Siang (2018) argued that during prototyping you should pay attention to the following:

- People—including those whom you are testing and the observers. Because we design for humans, we are particularly interested in how humans interact with and perceive the usefulness of our designs.
- Objects—including the prototype and other objects people interact with, because what people choose to do and the objects they choose to interact with can provide clues into why they like or do not like our design.
- Location—such as places and environments, because we can learn from where people choose to use designs, and why they use them in those locations, and what affordances those locations provide for using the design.
- Interactions—including digital or physical interactions between people, the objects, and the environment. This is particularly essential because the interactions we observe provide clues into how the design could be used, and any unintended outcomes.

Similarly in our field, Andrew Gibbons (2013) has argued that every instructional design is comprised of various layers, such as the following:

- *Content*, or the actual material to be learned
- *Strategy*, or the unifying framework about how the teaching/learning is theorized to happen, or how the tasks involved in learning should take place
- *Control*, or how students interact with and provide input back into the learning material
- *Message*, or the intended meaning the instruction is meant to communicate to the learner
- *Representation*, or how the layers of the design are presented to learners (visual, audio, touch, etc.)
- *Media-logic*, or the background structures that activate each component of the instruction at the proper time and in the proper way
- *Management*, or how data about people’s use of the instruction is collected and managed to improve learning and communicate about outcomes to stakeholders.

A design prototype, then, should serve to test one or all of these components from Dam and Siang and/or Gibbons. In other words, a high fidelity prototype, created close before implementation, would likely try to test all of these components. An earlier prototype may focus on one or two, perhaps testing primarily the validity of the content or messaging layers, the ability of the learner to control the interface, or the reliability of the media.

Prototyping Stages and Goals for Each Stage

In our opinion, there are three key stages for prototyping, and there are different primary goals for each stage, as described in Table 1.

Table 1*Prototyping Stages and Goals*

Prototyping Stage	Prototyping Goals
Static/paper—These prototypes can be created on paper or digitally, but typically are static and do not involve interactivity, graphic design, or other expensive features. These are often “Wizard of Oz” or paper prototypes, described below.	The primary goal is to test the logic of the design with users, experts, and clients. Do they think this is likely to succeed? Which aspects or attributes of the design do they think warrant full development? Does this design seem like a good answer to the instructional problem? Are we using the best content? What insights do they have now about how to present the final product (e.g. what media format, location, or scale should we aim for)? This is also a good time to estimate the potential costs in time and money to develop the design, and to ensure all parties feel the scope is accurate.
Low fidelity product/process—These prototypes have minimal interactivity and visual storyboards instead of full graphics.	Low fidelity prototypes are produced to give users and clients a better idea about how a design may look and interact, and how instructional content and strategies will be presented. Things do not work perfectly, but the focus is on testing the ideas, interaction, and potential of the design.
High fidelity product/process—These prototypes should be nearly completed designs, and ready for rigorous internal testing.	First impressions often matter a great deal, so before launching a product with actual users, ready-to-launch prototypes should be rigorously tested internally or with a sample of users. This process is usually repeated multiple times with larger groups of people until there is confidence that most of the design bugs have been identified, the product works reasonably well, and users will be able to use the product as intended.
Beta or soft launch of the design—Many designers now choose to launch a design in beta form, allowing users full range of access to the design, but without a promise that everything will work perfectly.	The goal of this stage is to fully test all aspects of the design, including user satisfaction and implementation costs. However, by keeping the design in beta, there is still flexibility to redesign an aspect not working very well, and usually users will be more forgiving.
Full launch/implementation	Even when we feel a design is “done” or ready for launch, we continue to collect confirmative or “continuous” (Wiley and Bodily, 2020) evaluation data on how well it is working and make adjustments as needed.

Prototyping Strategies

There are many strategies to prototyping ideas. Essentially, whatever you as a designer can do to test out any aspect of your design is a prototype. For example, this can be something visual, tactile, auditory, or performance-related. Following are some of the most common prototyping strategies.

Sketching

Sketches are “rough drawings representing the chief features of an object or scene and often made as a preliminary study” (Sketches, n.d.). For an example of a sketch, see Figure 1. Because sketches are simple and easily created, they are used by designers in the automotive industry to develop new design concepts. Researchers studied six designers at the Ford design studio to understand the physical and mental processes these designers go through as they sketch. They compared the process of these professional designers to student designers to ascertain the differences between the two groups. Findings indicated that, when compared to novice designers, professionals have a greater

understanding of physical dimension and used an iterative design approach in which they used sketches to facilitate problem solving and creative thought (Tovey et al., 2003).

Figure 1

Sketch of Exhibit Design Layout



Note. Many of the examples provided in this chapter come from museum exhibit design, which was the background of the lead author.

As illustrated by the automotive designers, sketches elucidate aspects of the parallel development of the designer and the product. Sketches allow designers to set out ideas spontaneously (Bilda et al., 2006; Segers et al., 2005) without investing much in terms of time (Rodgers et al., 2000; Stones & Cassidy, 2010) and money (McGown et al., 1998). Expert designers are more adept at using visuals, suggesting that visuals are often a part of their professional development (Bilda et al., 2006). These visuals also contribute significantly to the design process (Dörner, 1999; Jonson, 2005; Kavakli & Gero, 2001; Suwa & Tversky, 1997; Teng et al., 2014) and are said to be essential for conceptual designing (Bilda et al., 2006). Designers use sketches to focus their non-verbal thinking (Rodgers et al., 2000), consider the idea as both its component parts and as a whole (Bilda et al., 2006), and tap into the deeper meaning and implications of their ideas (Eppler & Kernbach, 2016). Sketching enlivens previously only imagined designs (Bilda et al., 2006; Tovey et al., 2003). Through sketching, designers can embody and explore ideas that are not fully developed (Rodgers et al., 2000), communicate the physical nature of an idea (McGown et al., 1998), and subsequently clarify its characteristics to determine what will and will not work (Dörner, 1999). All of these activities are critical in the product development process.

Storyboarding

Sketch methods lead to the creation of storyboards because key ideas and images can be created and then organized in a storyboard sequence (Teng et al., 2014). Storyboards are “a panel or series of panels on which a set of sketches is arranged depicting consecutively the important changes of scene and action in a series of shots” (Storyboards, n.d.). Storyboards are an exploration, analysis, and conceptualization tool generally used later in the design process once ideas from sketches have been evaluated and selected for development.

The development of storyboards often starts with a collection of individual drawings that represent single scenes, which are part of the whole design being drawn. Each separate depiction in the storyboard represents a specific scene or perspective. Taken together, they represent the sequence in which things will flow.

Storyboards are utilized in cinematography, live television, animation, and special effects to plan the details of how a story will be portrayed (Teng et al., 2014). In architecture, they are used to visualize presentations of projects by creating analog versions of proposed buildings that will later be digitally designed (Cristiano, 2007). In other design contexts such as industrial design, storyboarding is a way of visually recording social, environmental, and technical factors that affect the context of how end users will interact with the product (Martin & Hanington, 2012).

Storyboards were used by students at Georgia Institute of Technology in their industrial design classes. When working on a product development project to redesign travel luggage, students performed research about the needs of consumers as well as market standards as a basis for beginning their design project. After completing the research, students storyboarded their designs to show how luggage is handled through the whole travel experience from storage, packing, passing security, walking through the airport, boarding the airplane, loading it into the overhead bins, and ultimately back into storage. These storyboards facilitated discussions about various design features and how to prioritize them to meet user needs (Reeder, 2005b).

As this example demonstrates, storyboards can contribute to product development because they are drawn with the target audience in mind (Martin & Hanington, 2012) and visually describe how users will interact with the product. When designers examine design challenges in depth using storyboards, they can understand the complexity of the situation and consider individual portions of the situation while not losing sight of the whole (Reeder, 2005a). They can visually document how users will interact with the product and use this documentation to develop innovative product solutions that address the needs and expectations of users (Reeder, 2005a). In general, storyboards act as a visual budget, which helps the production process run more smoothly by planning and allocating resources effectively (Cristiano, 2007). Because nothing is fixed or unchangeable, storyboarding is a flexible way of trying out ideas and incorporating changes; ideas can easily evolve as they are drawn in storyboards (Glebas, 2013), as was the case with the exhibit pictured in Figure 2.

Figure 2

Storyboard of Ostraka Layout

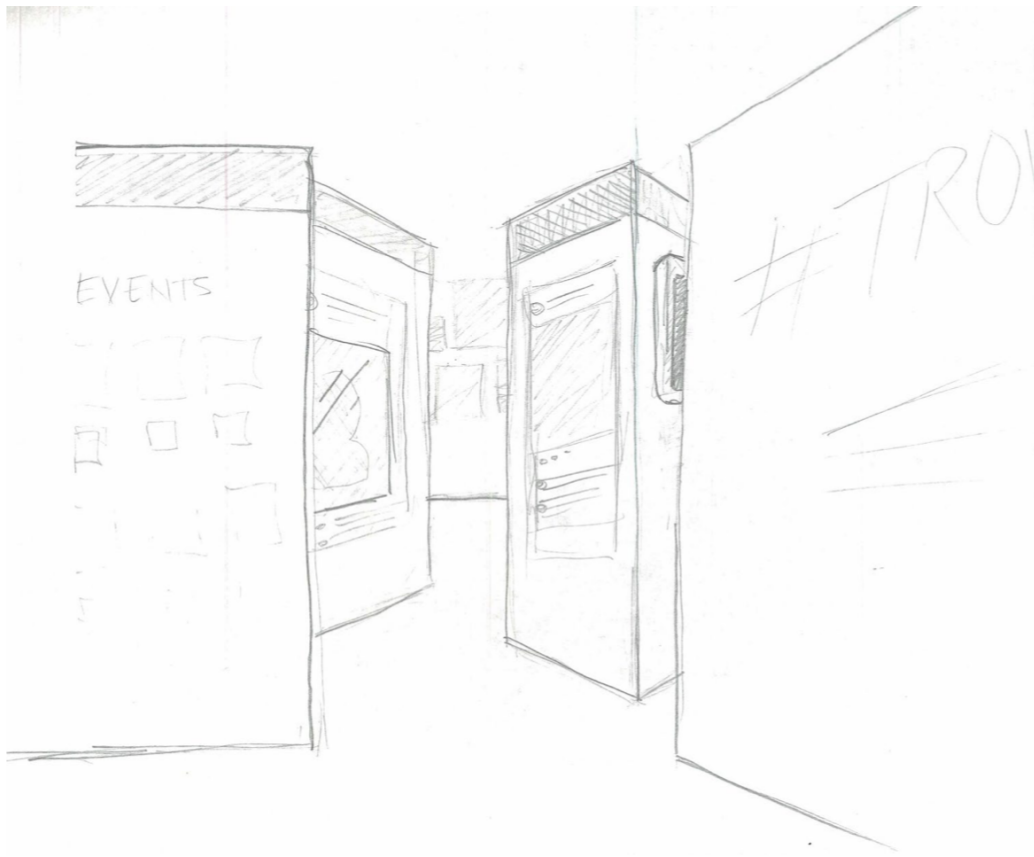


Figure 3

Storyboard Example

"Try it out"



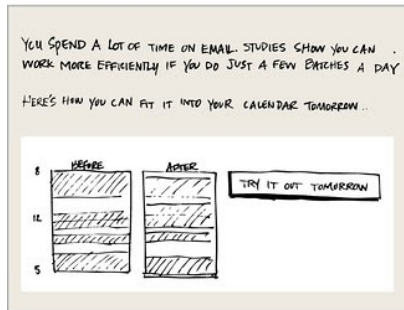
Lisa hears about Equilibrium from a co-worker, who mentions that it's a cool way to see how you spend your time.



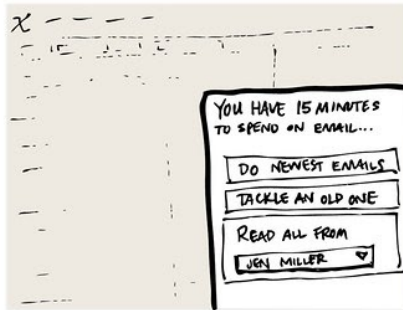
She checks it out and is intrigued by the idea of a report based on her own schedule.



She sees an interesting picture of how she's really spending her time.



She sees that she can get simple suggestions based on her real calendar, and that she can easily "try out" Equilibrium's features.



The next day, she gets interesting and timely reminders.



She signs up to receive other reminders for good-for-her things throughout the day.

Note. CC-BY from Rosenfeld Media, available at <https://edtechbooks.org/-kzST>.

Product Builds

Product builds are any three-dimensional representation of an idea that an audience and designer can manipulate and experience. They can be as complex as working versions of a tool, 3-D prints, or even Lego/fabric-based lower fidelity builds. They can also be of varying levels of fidelity, as initial product builds may include a few layers of the design (such as the physical shape and visual coloring/representation). However, later prototypes can have increasing more fidelity, including prototyping various versions of audio, music, content, and dynamic interactivity to test how effective each new design element is.

Product builds are seen as an essential design activity because it allows designers to learn by doing as they explore ideas (Camere & Bordegoni, 2015). This is a practice common to many fields, including experience design (Buchenau & Suri, 2000), education (Barab & Plucker, 2002), engineering (Alley et al., 2011), social innovation (Brown & Wyatt, 2015), and instructional design (Merrill & Wilson, 2007).

As an example, engineers at a precision pump manufacturing organization were tasked with creating a new line of pumps for a food processing chain. The pumps needed to be more efficient and have fewer parts than the originals. The core design team was co-located and created prototypes to test their new designs. The use of prototypes contributed to the direct aural and visual communication team members had with each other. The prototypes were critiqued and approved, and in this way they structured the design process for the engineers (Perry & Sanderson, 1998).

As this engineering example illustrates, product builds are a valuable communication tool. They can provide a shared, tangible view of an idea and facilitate answering questions concretely (Yang, 2005). They can also be used to persuade others to adopt a new mindset because they tangibly demonstrate the merit of an idea. Prototypes can be a source of positive peer pressure to move forward with the development of ideas (Norris & Tisdale, 2013).

Product builds also reveal information about the designs through the process of fabrication. Creating prototypes reduces design risk because designers can learn about the product-to-be without investing the time and cost required for full production (Yang, 2005). This technique helps designers determine how to fulfill the tasks and requirements that must be accomplished for a given project (Smith, 2014). Designers learn from the mistakes they make on prototypes and the feedback they receive about their prototypes, which then leads to improved designs, as was the case with the prototype pictured in Figure 4. This is an iterative process that continues until they reach a product that will accomplish the desired results.

Figure 4

Product Build of an Early Iteration of a Museum Exhibit



Bodystorming, or Role-Playing

Bodystorming is a method in which brainstorming is made physical. During bodystorming, role-playing and simulation with simple prototypes is done to create informative performances that illustrate what it might be like to use a product that is under development (Martin & Hanington, 2012). Bodystorming is a way of developing greater user empathy: designers immerse themselves in situations end users might experience and then focus on the decisions, emotional reactions, and interactive experiences users might have. This approach is based on the premise that the best way to understand an interaction is to experience it personally (Smith, 2014).

Participating in the interactions users might have can reduce the time designers spend studying documents of user observation. It allows them to tap into aspects that are unobservable because they have experienced these elements firsthand (Oulasvirta et al., 2003). This technique has the potential to help designers communicate better with their peers, clients, and end users because of the performance aspect of this type of visual (Burns et al., 1994).

Designers at the Helsinki Institute for Information Technology enlisted 10 researchers and industry representatives to use bodystorming to innovate ubiquitous computing technologies. They spent a full day bodystorming the interactions an elderly user group would have at an old age service house, subway station, the subway, the mall, and a grocery store. They identified problems related to activities performed at each of these locations and framed them as design questions. Those involved were split into two groups to perform the bodystorming. One researcher acted as a moderator, while another served as a group leader. These researchers recorded ideas that emerged and facilitated the experience. They found that bodystorming inspired researchers to become familiar with new contexts and improve their design abilities (Oulasvirta et al., 2003).

This example of bodystorming presents how this visual tool can support the product development process through facilitating communication across peers, clients, and users. Like the other forms of visual representation, it offers a shared perspective to all involved, which provides opportunities for further discussions (Burns et al., 1994). However, it contributes differently than other visuals. It allows designers to experience, discuss, and evaluate their ideas in context, and helps designers to understand how the settings in which a design is used can affect their intended use (Smith, 2014).

This approach is believed to be less error-prone than brainstorming because it allows designers to experience realistic constraints that can affect the user experience (Smith, 2014). In bodystorming, designers rapidly prototype ideas, which allows for immediate feedback on how the product works (Oulasvirta et al., 2003). Discussing the feedback brings up new issues for designers to explore (Flink & Odde, 2012).

Wizard of Oz Prototypes

In the movie/book, *The Wizard of Oz*, Dorothy and her companions seek the wisdom and power of the Great Oz to grant their wishes. However, what they thought was an all-powerful wizard was really a man behind the curtain, pulling levers and pushing buttons to give the effect of something magical happening. Similarly, in Wizard of Oz prototyping, the designer creates a low fidelity or paper prototype, but without the interactivity or dynamic responses from the system. Instead, when a user or prototype tester wants to do something, they indicate where they would go, or what they would click, and the designer provides the next low fidelity prototype example. In this way, they simulate the interaction that they will eventually build into the system. In essence, as Dam and Siang (2018) explained these are “prototypes with faked functions.”

Sometimes this “faking” can be more complex, with a human on one side of a screen typing responses to the user that appear to come from the computer. As another example, a popular experience at Disneyland theme parks is *Turtle Talk with Crush* (shown in Figure 5), where children talk to Crush, the popular turtle from *Finding Nemo*, through a computer screen. On the other side of the screen, the performers make Crush respond to the children in authentic ways that make Crush seem real. This perhaps also exemplifies an ethical issue with Wizard of Oz prototyping as many young children really do think Crush is real. Even with adults, some Wizard of Oz prototyping can appear realistic, and participants should be informed that they are not, in reality, interacting with a real product.

Figure 5

Turtle Talk at Disney World



Note. Photo CC-BY/SA from Josh Hallet and available at <https://edtechbooks.org/-SmA>.

User-Driven Prototypes

Dam and Siang (2018) described one final prototyping strategy, where instead of designers creating prototypes for users, the users create prototypes for the designers. They explained that this can be a way of understanding the users and developing empathy. “When you ask the user to design a solution, rather than provide feedback on a prototype, you can learn about the [assumptions](#) and desires that the user possesses. The purpose of a user-driven prototype is not to use the solutions that the users have generated; instead, it is to use their designs to understand their thinking.”

According to Dam and Siang (2018), a designer sets up user-driven prototyping by asking users to design specifically to answer questions designers have. They provide the example of airport designers asking users to sketch or build what they think an ideal experience would look like.

Conclusion

Prototyping is an essential strategy for testing out emerging designs and refining ideas before expensive implementation launches. In addition, prototyping is an essential part of the design process itself because prototypes help to structure the collaborations on a design team and represent the distributed cognition of design teams and how ideas are negotiated by team members (Henderson, 1998). Thus, design cultures or styles are intrinsically tied to the way in which each constructs representations of their ideas. Such prototypes—e.g. sketches, drawings, bodystorming, etc.—are the heart of design work and constitute the space in which ideas are defined, refined, and negotiated. (Henderson, 1998, p. 141). A team’s ability to create, interpret, and communicate with prototypes can facilitate or restrict how they interact as a group, making these prototypes “primary players in the social construction of the design culture or design style of the designing group” (Henderson, 1998, p. 140). Thus, it is essential that designers think deliberately about how they use prototypes as part of an effective team design culture.

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Navigating Worlds of Significance: How Design Critiques Matter to Studio Participants

Jason K. McDonald, Esther Michela, & Peter J. Rich

Design

Instructional Design

Critique

Case Study

In this chapter we explore the design critique as a way that students and instructors (or other critics) navigate the complex worlds of significance made available to them through their involvement in studio pedagogy. We do this by first situating design critiques in a body of research and theoretical literature that explains what it means for studio participants to use critiques to navigate worlds of significance, and then by presenting a case study of a critique process we have used with design students that is sensitive to their attempts to navigate their own worlds of significance. This process was developed in our instructional design graduate program, where beginners are enrolled in a first-year, introductory studio class in instructional design, and their critics are enrolled in a second-year, advanced instructional design class. Over the duration of a semester, the more advanced students lead three hour-long critique sessions with a small number of beginning students after the beginners have reached various milestones in their first instructional design project. The case helps illustrate how critiques can be framed in a manner that better enables both students and critics to pursue possibilities the studio makes available to them, building a life that matters and that they can view as being excellent and worthwhile.

Introduction

In this chapter we explore the design critique as a way that students and instructors (or other critics) navigate the complex worlds of significance that are made available to them through their involvement in studio pedagogy. In this view, studio participants are seen first as active agents, using critiques to bring about social, pedagogical, or personal possibilities that matter to them (Yanchar, 2018), including the possibility of achieving excellence in their chosen design field (cf. Taylor, 1985). This does not discount that critiques can also accomplish other purposes, such as helping students develop design knowledge (Cennamo & Brandt, 2012), or socializing them into the norms and habits of a discipline (Scagnetti, 2017). But these are specific ways that critiques might be significant to studio participants, not

their ultimate ends. So they are better understood as “actions . . . [that] figure into the composition of [studio participants’] life story as a whole” (Guignon, 2012, p. 101), rather than being an independent force that critics can use to generate certain outcomes.

Our chapter consists of two parts. First, we situate design critiques in a body of research and theoretical literature that explains what it means for studio participants to use them to navigate worlds of significance. Second, we present a case study of a critique process we have used with design students that is sensitive to their attempts to navigate their own worlds of significance. We offer this case as a model for how studio instructors might design critique processes in a manner that aligns with participants’ efforts to balance the various goods they aim to achieve (including their own efforts as parties also invested in the outcomes of studio curricula), and to take stands on the various possibilities they see being made available to them.

Background

As we (the first and second authors) have studied critiques in a variety of settings, we have seen how they are inescapably related to the values, goals, and different forms of the good that studio participants pursue through their participation in the pedagogy, to both positive and negative ends. This is what we mean by describing critiques as fitting into the worlds of significance of design studio participants (see Dreyfus, 1991, p. 97). This does not imply that those in the studio always see critiques as constructive or helpful. Saying that critiques contribute towards one’s world of significance draws attention to the fact that they always matter in some fashion, but we recognize that the specific reasons could be favorable or unfavorable (it is possible, after all, for critiques to impede participants’ ability to achieve forms of excellence towards which they are drawn; see Gray & Smith, 2016). As we have said elsewhere:

Critiques always mean something to [those participating in] them. . . . This is true whether they embrace the critique, try to escape it, or are simply bored of it; whether they feel compelled to critique by forces outside of their control, or would use critiques even if they were punished for doing so. (McDonald & Michela, 2019, pp. 1-2, emphasis in original)

For example, we have observed how studio instructors use critiques as a concrete practice for achieving a variety of desirable ends in their own worlds of significance. Instructors do not view their studio participation in terms of singular, or even well-defined, objectives. The studio opens up a number of possibilities to them – sometimes possibilities that they do not clearly understand – and critiques are a means both for bringing these possibilities into focus and for accomplishing ends they view as worth pursuing. These include outward-facing goals such as student growth or the enforcement of disciplinary standards of excellence, but also individual reasons such as the creation of a working environment they find personally rewarding (McDonald & Michela, 2019). These forms of the good are not always compatible with each other, and inconsistencies between them (such as when what is best for a students’ emotional state may conflict with enforcing a disciplinary norm) can create tensions for instructors who find themselves pulled between various possibilities. To cope, some instructors described the importance of certain dispositions in their approach to critiques that help them balance the pursuit of different goods. These include a tolerance for risk, being attentive to the particular needs of critique situations, taking measures to act carefully when faced with complexity, and developing a sense of self-possession that helps them remain composed even when faced with a difficult challenge or the consequences of a mistake (McDonald & Michela, under review). So to say that critiques are how instructors navigate their worlds of significance implies that critiques help them move productively through an environment of uncertainty, and help them become a type of studio contributor they can view as capable of succeeding in such an unpredictable environment.

Recognizing this duality draws attention to an important facet of what it means for a practice like critique to be significant for participants. There is a relationship between how one engages in a practice (including what one accomplishes), and who one becomes through participation in that practice. But this is not a one-way relationship in which the practices dominate or control what one eventually becomes. People are not passive objects in the world, being acted upon by deterministic, cultural forces outside of their control. When they act within a world of significance, they are taking stands on the various possibilities they see being presented to them (Brinkmann, 2008). While it is true

that, most of the time, people do not have the choice of what those possibilities are, when they encounter a possibility they do make meaningful choices that “can be viewed as a kind of commentary on the options and possibilities made available through [their] cultural [or organizational] heritage” (Yanchar & Slife, 2017, p. 151). As Guignon (2012) stated: =

One’s existence is brought to expression and worked out in the concrete stands we take in actually living our lives. We find ourselves thrown into a world that is not of our own choosing, but once we are in that world, we find ourselves faced with an array of possibilities or choices that are laid out in advance by the cultural context in which we find ourselves. On the basis of these possibilities, we can enter into professions, come to embody certain personality types, develop distinctive sorts of character, and undertake such mundane actions as riding a bike, doing the laundry, or reading a novel. Whether we realize it or not, we are always choosing possibilities of action in what we do (pp. 100; emphasis in original)

In the context of the studio, this implies that while critiques allow instructors to both accomplish something they believe is good and become someone they view as good, these are not two distinct outcomes that happen to result from the same process. They are different ways of focusing on the same phenomenon of what it means for someone to be involved in a certain world (Taylor, 1989). People are equally complicit in what they become (Merleau-Ponty, 2004), and should not be seen as being the product of what a certain society or culture imposes on them.

The same is true for students who are the recipients of critiques. In our research into student critiques we have seen that being critiqued does not mean that one is subjected to causal forces that deterministically produce a certain kind of outcome, such as critiques causing learning, or causing enculturation into a community of practice. Rather, we observed that students use critiques to take up specific ways of life that studio participation makes available to them, including helping them develop into the types of designers they desire to become. They did this through being selective in responding to critiques—trying to identify what were useful and timely suggestions, and paying attention to those while disregarding feedback they thought was more inconsequential. They also used the form and substance of critiques themselves to judge whether their critics were trustworthy, and whether the feedback those critics provided should be implemented (McDonald & Michela, 2020). What was often more important than the substance (or content) of a critique was that critiques, as a shared experience, provided an opportunity for both critics and students to build a relationship with each other. These relationships, in turn, changed how students saw critiques as a source of useful knowledge in both positive and negative ways (Michela & McDonald, 2020). Finally, students actively interpreted critiques in a manner that aligned with the growth towards which they were striving, regardless of the literal meaning of the feedback that critics offered (McDonald & Michela, 2020).

It is through these types of active engagements with critiques—taking stands, exploring possibilities, and pursuing saliences they recognize as being significant—that students help create the outcomes that are often promoted as a reason critiques should be used as a pedagogical approach. For instance, and as has been mentioned, critiques do not possess an innate power to enculturate students with the identity of a professional designer. Rather, when they are critiqued students are confronted with various possibilities, and choose to follow some of those possibilities over others. Do they listen to the critique or not? Do they resist or not? Do they reshape their work in response to the feedback or not? If their particular studio does not give them the option to actively resist, do they resent the feedback they are given or not? Each response opens up new possibilities while closing down others, and as students continue with certain patterns of possibility they shape themselves into what is typically called their identity as a designer, “gain[ing] an understanding of who [they are]. . . . Maybe [they] never put this understanding into words, but [their] life still makes sense to [them]” (Polt, 1999, p. 34). This, in turn, affects how they see their place in the design profession, and even how they define their profession itself:

[They] are necessarily aware of the world in which [they] operate. If [they] understand what it is to be a [designer], [they] also understand . . . what one can expect to find [when designing]. So [they] understand not only [themselves], but also the various kinds of things and people [they] encounter around [them] in the process of being [themselves]: students, colleagues, buildings, books, plants, roads. All these items have meaning for [them]” (Polt, 1999, p. 34).

Or, as Guignon (2012) stated, “what is definitive of a person’s identity as an agent is not so much what goes on in her mind as the way her actions at any time figure into the composition of her life story as a whole” (p. 101). The process of building that life story, which in the studio is defined in large part through the giving and/or receiving of critiques, is ultimately what we mean when we say that critiques help studio participants navigate their worlds of significance. What they are navigating is a world that allows them to build a life that matters to them, hopefully one they can view as being excellent and worthwhile.

A Case Study Of Critiques In Design Students’ Worlds Of Significance

This view – that critiques help studio participants navigate their worlds of significance – can be seen in a case study of an informal, small group critique process, where beginning design students are given feedback by other students who have additional experience. We have developed this process in our instructional design graduate program, where beginners are enrolled in a first-year, introductory studio class in instructional design, and their critics are enrolled in a second-year, advanced instructional design class. Over the duration of a semester, the more advanced students lead three critiques with a small number of beginning students after the beginners have reached various milestones in their first instructional design project. The first and third authors of this chapter are instructors of the courses referred to throughout the chapter, while the second is a former student who experienced the process both as a beginning student and later as a critic.

As we introduce our group critique process we emphasize that our purpose is not to describe an unprecedented strategy. We expect, in fact, that readers will find at least some similarities between this process and others with which they are familiar, or perhaps already using. Rather, we offer it as an example of how one can see critiques as being a way that studio participants—both beginning designers and more advanced peer critics—navigate different worlds of significance. Our belief is that this case can serve as a model that helps readers recognize similar issues in other critique practices. Additionally, we note that although we originally designed our critiques before carrying out our research into studio participants’ worlds of significance, as we have improved the process over time we have tried to arrange the environment in which the critiques take place to support our critics in successfully balancing many of the goods towards which they might feel committed. Consistent with our views of what critiques can offer students, we have also attempted to improve the process so that it encourages those who receive critiques to reflect on how they can shape feedback to achieve their own goals, rather than taking feedback they are given as requirements they are obligated to implement. We will identify some of the possible connections between our research and our process in what follows; we encourage readers to look for other connections that might be useful for them.

Context

The context of our process is an introductory course in instructional design, a required course for all students enrolled in our instructional design graduate program. Instructional design is a discipline concerned with the design and development of both formal and informal learning experiences in a variety of settings (e.g., K-12 classrooms, higher education, on-the-job training, personal learning and development). This particular course is meant for students to take during their first year, and is structured around a semester-long project to develop an online learning module, either for a client or on a topic of personal interest. The critics are enrolled in our advanced instructional design course, typically during their second year in their graduate program. Many of our students come from backgrounds in education, psychology, or other social sciences. Being critiqued is a new experience for them and so, as will be seen, we offer some direct instruction to teach them what it means to give and receive critiques. Our process should still be applicable for students who already have experience with various critique processes, and useful in any design course in which students complete projects over a significant period of time.

Preparation for the group critiques begins early in the semester. We schedule three critiques, aligned with key milestones that beginning students will complete during the course of their project: 1) their initial description of an educational challenge they think can be improved by an online module (usually around week three of the 15-week

semester); 2) completion of the first prototype of their module (around week six); and 3) completion of the last prototype before they finalize their design and complete the project (around week ten). These stages were selected to maximize the impact of the peer critic. Critiques of students' initial ideas helps them think more carefully about the problem they are trying to solve, and allows critics to suggest (if necessary) that they redirect their thinking towards more productive possibilities. Critiques at the first prototype milestone facilitate similar redirection, or at least refinement, of beginners' work before they have invested significant time on aspects of their design that may ultimately prove to be ineffective. Critiques of the final prototype encourage beginners to polish their nearly final designs to be as compelling and effective as possible.

The unique contribution of our approach is found in the next phase of our preparation: a set of orientations for both beginning and advanced students. As noted, while we initially designed this process before carrying out research into design critiques, we have adjusted our procedure over time to align how we orient our participants with what we have learned about critiques being situated in their worlds of significance.

We first orient the critics. While this is partially a logistical orientation (e.g., informing students of how many beginners they will critique; that the experience will be a group critique; when and where the critiques will take place), most of the meeting is spent on preparing them to critique in a manner that is sensitive to both their own and the beginners' worlds of significance. We begin by asking student critics to reflect on critiques that have been most useful to them, followed by a discussion of practical strategies they might try during the upcoming critiques to encourage the same kinds of outcomes. We then provide them with a job aid that summarizes lessons we have learned from both scholarship and other critics about conducting effective critiques (see Figure 1). It is important to our process, however, that we not overly prescribe techniques for them to employ. Consistent with our view of them as attempting to balance competing and sometimes contradictory goods, our aim is to give them enough support so they can confidently engage in the new situation, but to also make room for them to explore how to critique in a manner that is sensitive to their own interests and aims. Additionally, we also set an expectation that they should not only attend to their own interests but also respect the beginners' agency and ownership over their own work.

Figure 1

A job aid to prepare peer critics for the group critique process.

Group Critique Ideas

1. Work as a group: set the expectation that you are not lecturing, but want everyone in the group to contribute thoughts and ideas.
2. Clarify the purpose, rationale, and expectations students have for their project, before offering suggestions.
3. Involve the students to help clarify and add to the evaluation criteria for your group critique.
4. Examine the students' work—prototypes, design documents, or other artifacts from their projects.
5. Provide clarifying concepts, examples, and ideas from your own coursework and practical experience.
6. Practice “just-in-time” instruction: present ideas and suggestions when it becomes obvious they will be relevant for what the students are working on now.
7. Try to conclude your review by summarizing the discussion into a few guidelines or principles.
8. When giving feedback:
 - Describe what you see/hear/experience from the work being discussed;
 - Indicate the outcomes or other consequences you think will follow from what you observe;
 - Brainstorm solutions with all students in the group about how to address any shortcomings you see.
9. Remember, you are reviewing other students' projects and not your own. Help them be as successful as they can with the projects they've chosen and with the skills they have. Don't try to make them to do a project you would prefer to do.

We prepare beginners using a similar approach. We introduce them to the idea of critique, guide them to reflect on times they have received feedback on creative activities, and discuss what they think has made a difference for them in using feedback to improve their work. We then discuss a set of strategies that can help them productively respond to critiques, and use the feedback they receive to better accomplish their aims and goals for their project (see Figure 2). Readers will note how our strategies explicitly encourage beginners to use the critique process to help them better accomplish their own aims and goals – to press forward into possibilities that are important to them – and not merely accept the suggestions of their critics as directives they are required to implement. For instance, our final strategy is a heuristic for quickly judging the validity of feedback that critics offer. While we are not aware of research either confirming or refuting the idea that critiques are typically more valid in identifying problems in one's work than in offering specific ideas for fixing problems, it does seem to align with our practical experience in receiving critiques ourselves. It also seems to logically follow from a view that the beginners' personal investment in their projects offers them a perspective on addressing shortcomings in their work that is not available to a more detached, external critic (McDonald & Michela, 2020).

Receiving critiques

- Share your goals for the project and for this critique session
- Provide context and background to help others offer informed critiques
- Walk through your work and explain your rationale
- Take notes on the feedback
- Ask questions to make sure you understand
- Avoid being defensive
- You don't have to agree to apply all the feedback you receive, but you should at least listen to everything you're told
- When evaluating the feedback you receive, remember that
 - If someone tells you there is a problem they're almost always right
 - If they try to specifically identify the problem they might be right; consider their suggestions in light of everything you know about your situation
 - If they try to tell you how to fix the problem they're only occasionally right; but you can still learn from their suggestions if you consider them carefully in light of everything else you know about your project

Figure 2. Strategies discussed with beginners before they receive their first critique.

During the first critique we assign each critic three or four beginners to work with, depending on the number of students enrolled in the introductory and advanced courses. We have experimented with both persistent groups, where each critic works with the same beginners throughout the semester, and flexible groups, where beginners are assigned to different critics in later critiques. We prefer the persistent model, which minimizes the amount of time required for students to re-explain the context of their projects during critiques two and three. Unless there are extenuating circumstances, the expectation is that critiques will take place in class, in the form of a small group discussion lead by the critic. As each critique begins we offer a set of guidelines or criteria to help guide the critiques (see Figure 3), but critics (as well as other beginners in the group) are encouraged to offer whatever feedback they think will be most useful. Each critic prompts beginners to present their work, offers input, and solicits input from other beginning students in his or her group. Each of the critiques lasts 60–75 minutes.

Evaluating prototypes

- **Alignment.** Is the prototype aligned with the learning goals? Is it appropriate for the learner group?
- **Rigor.** Does the prototype show evidence of thought, work, and attention to detail (that corresponds to the needed fidelity)
- **Evaluation.** Was there a defined purpose for the prototype? What was hoped to be learned from it? How was it evaluated? How are evaluation findings being used (or planned to be used)?

Figure 3. Example criteria to guide group critiques.

After each critique we hold a short debriefing session with the students. With critics we discuss what went well, what they would like to change during future critiques, and what they learned from the process of offering critiques. With beginners we help them evaluate the feedback they received, but also discuss what they learned about critiques more generally to help them prepare for future critique experiences.

Outcomes of the process

We have carried out versions of our group critiques for four years, refining them slightly each year to respond to feedback from students, what we have learned from our research, and our own evaluations of the process. An early evaluation is reported in McDonald et al. (2019), and the findings there seem to have been strengthened as we have improved the approach. Beginning students typically report the experience as helpful because the individual attention gives them a number of new ideas and perspectives to consider for their work. They also report that they develop confidence as they see the capabilities of critics who are only slightly ahead of them in the program, believing it to be an achievable goal for them to develop similar skills themselves. Critics also typically report the experience as helpful. Offering critiques improves their self-evaluation of their own skills. They often begin the process skeptical that they have useful suggestions to give beginning designers, or believing that their own skills have not advanced since they took the introductory class themselves. But over the course of the three critiques they often see that their instructional design knowledge and skills have both matured, and they are more capable than they originally judged themselves to be.

The second author of this chapter (Esther) experienced both sides of the process as a beginner and, a year later, as a critic. We report her experience in her voice:

As a beginner I came to the design review with a lot of anxiety about how my ideas would be perceived. Though I had experience as a teacher, I had no specific training in instructional design or the studio setting. Receiving critique from

anyone was nerve-wracking and especially from advanced students who I viewed as experts, at least compared to me. The actual review session was much less stressful than I had anticipated. The advanced student (critic) asked good questions that I didn't have all of the answers to, but which gave me things to think about. There was no judgment. Outside of class, I had the opportunity to work closely with my critic on another project, building a working relationship over several months. I quickly grew to trust him and felt that I could ask him for support in any questions that I might have. I gained both professional design experience and network connections.

A year later I returned as the advanced student, an intimidating "expert" as I had previously supposed advanced students were, realizing that I now had only one more year of experience to offer, feeling woefully inadequate. I was presented with the four new projects by students I hardly knew, who had varying levels of instructional design experience and significantly more expertise in their chosen subject matter than I. I spent most of the time trying to understand the projects, but felt internal pressure to come up with some helpful insights or suggestions. As I might have anticipated, there were projects for which I could suggest specific design changes and others for which I could suggest very little. Afterwards, I recognized that though I had gained design insight over the previous year, I could still learn much more and that simply being exposed to the four new design projects had expanded my still growing understanding of design.

Conclusion

In this chapter we have explored the design critique as a way that students and instructors in the design studio navigate the complex worlds of significance associated with studio pedagogy. Our intent was both theoretical and practical. We reviewed research that explains what it means for studio participants to navigate their worlds of significance using critiques as a concrete process. We also presented a case study of a group critique process and described how it is sensitive to the worlds of significance of design studio participants. Our intent in sharing this process is two-fold. First, we hope readers find our description and associated materials to be useful, and that they are able to achieve similar outcomes by adopting or adapting them for their own circumstances. We additionally hope that framing our process as an example of how critiques can support studio participants as they negotiate their worlds of significance is equally insightful, and illustrates how theoretical work into the critique can be practically applied in actual practice. By structuring critiques in ways that align with participants' efforts to balance the various goods they aim to achieve, or help them take stands on possibilities they see being made available to them, we believe that readers will be better able to contribute towards studio environments that participants find to be fulfilling and rewarding.

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Dr. Jason K. McDonald is a Professor of Instructional Psychology & Technology at Brigham Young University. He brings twenty-five years of experience in industry and academia, with a career spanning a wide-variety of roles connected to instructional design: face-to-face training; faculty development; corporate eLearning; story development for instructional films; and museum/exhibit design. He gained this experience as a university instructional designer; an executive for a large, international non-profit; a digital product director for a publishing company; and as an independent consultant.

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Simulations and Games

Jeff Batt

Learning

Educational Games

Scenarios

Simulations

Games

Using simulation games, learners can explore real-world scenarios in a safe environment. Simulation try, simulation watch, simulation evaluate, and simulation play are examples of simulation game scenarios that can help students learn. It is critical to establish a theme for your game in order to bring balance between the tone, visuals, audio, video, text, and other elements involved in its development. In addition, learners should be presented with a variety of challenges of varying levels of difficulty. Finally, you should consider how to manage interactions in simulations and games. There are three common ways: Variables, Triggers, and Conditions. Learning through simulation games could help learners to comprehend new concepts and then apply what they learn in a safe and controlled environment

Simulations present the learner with real-world scenarios and allow them to explore the scenario in a "safe" environment. A basic pattern for this is to (a) present or show the desired end result; (b) allow students to safely try the result out; (c) then evaluate if the student is able to complete the task; (d) and allow them to play around with the concepts in an engaging way to deepen their learning. Let's call these: present, try, evaluate, and play.

Present: Presenting starts by showing the learner how to perform a certain action. This could be by simply showing them a video or having them click through a series of slides or steps to see how to accomplish a task.

Try: Trying happens as the learner is placed in an environment that is reminiscent of the real-world environment, but this environment has been simplified, altered to minimize or eliminate risks, or has been otherwise modified to draw out the material to be learned. This is what we mean when we say a simulation is a "safe environment." For instance, in a simulated Information Technology environment, the learner can't cause a system to crash or accidentally send out secure user data as they try things out. You do want the simulated environment to be recognizable when compared to the real-world scenario, however, so that learners get an authentic experience and can transfer what they learned back into the real environment.

Evaluate: After learners have seen the desired outcome and tried it in a safe environment, you want to evaluate them: can they do it in an environment with no extra help and with real consequences? Evaluation helps both solidify lessons learned as well as providing the teacher/instructional designer insight into whether the learner can perform the task or not.

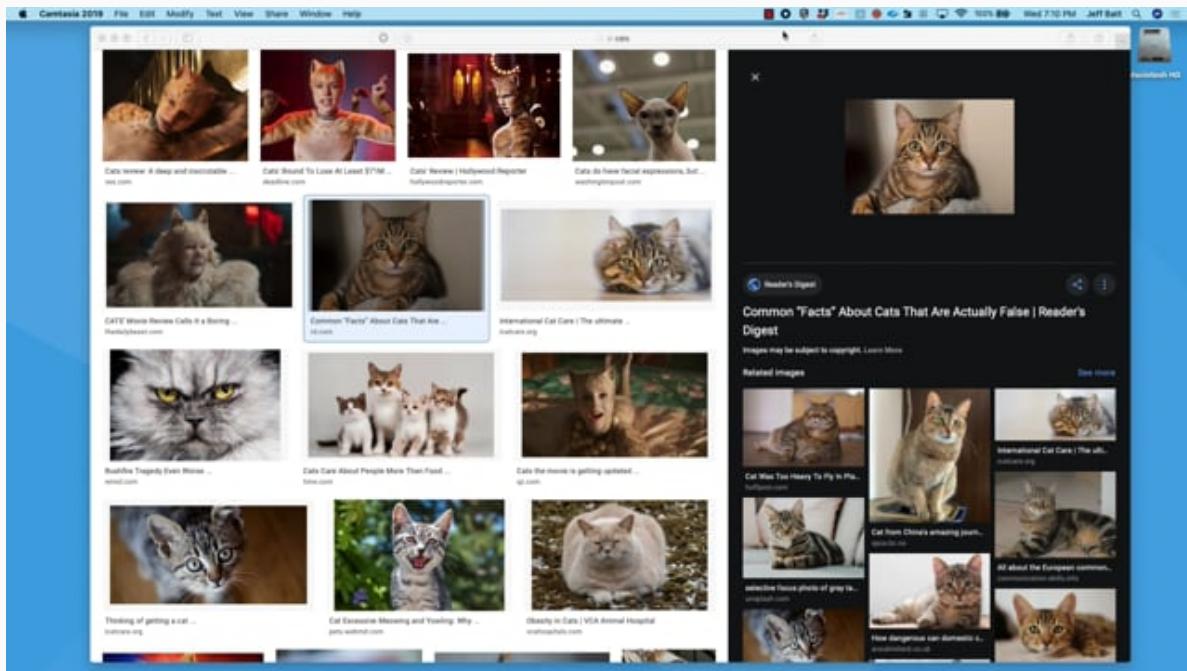
Play: Simulations and games allow for exploration; learners don't have to just proceed through the instructional material in a linear way. And even fun, exciting games can be educational; they create engagement that helps students learn the concepts in a different manner through their simulated play. Games can even create a desire for the student to "try again" to see if they can get a higher score or if they can master a concept. Gaming, then, could be a useful technique to help solidify the concepts being taught.

Keeping these four principles in mind, let's consider how they could be applied in some common scenarios.

Simulation—Watch

One form of an instructional simulation asks learners to watch a procedure or skill. One of the more common forms these simulations can take is the software simulation. A software simulation is essentially showing someone how to do some action on a computer by recording your screen. In Video 1 you can see an example of how to create a Watch simulation using the screen recording tool Camtasia.

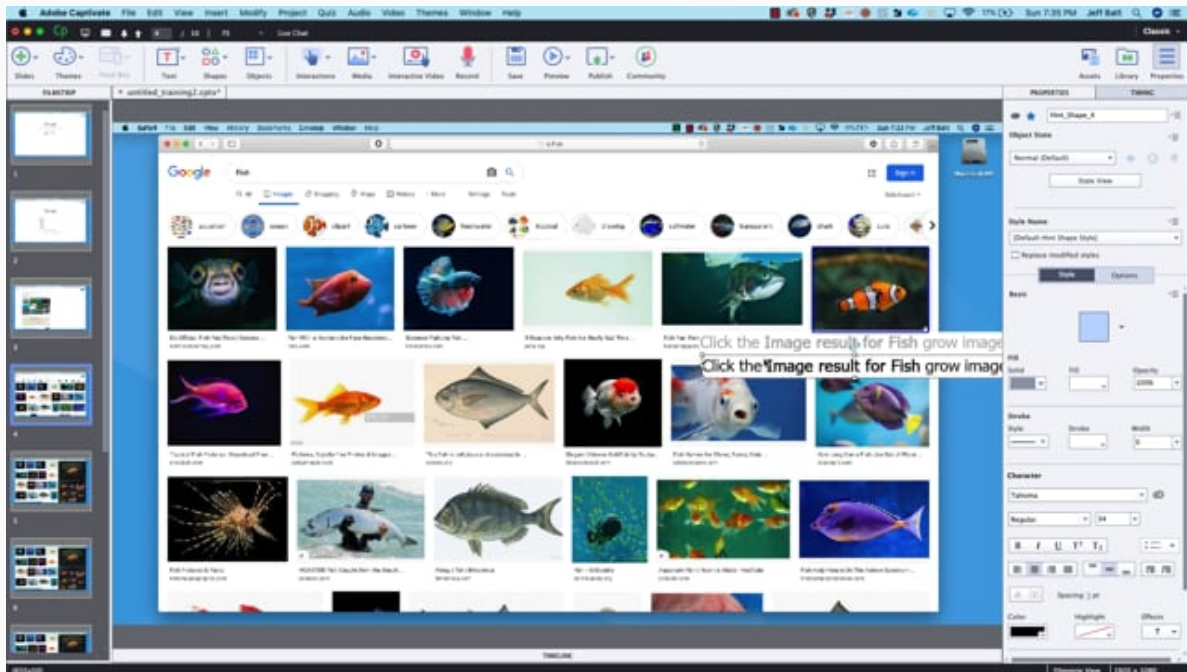
Video 1: How to Create a Watch Simulation



Simulation—Try

The next kind of simulation is one that allows students to try a skill or procedure themselves. This allows the learner to engage with the content and practice it in a safe environment. There are various applications that can be used for creating a Try simulation; in Video 2 you can see an example of how to create a Try simulation using the tool Captivate.

Video 2: How to Create a Try Simulation

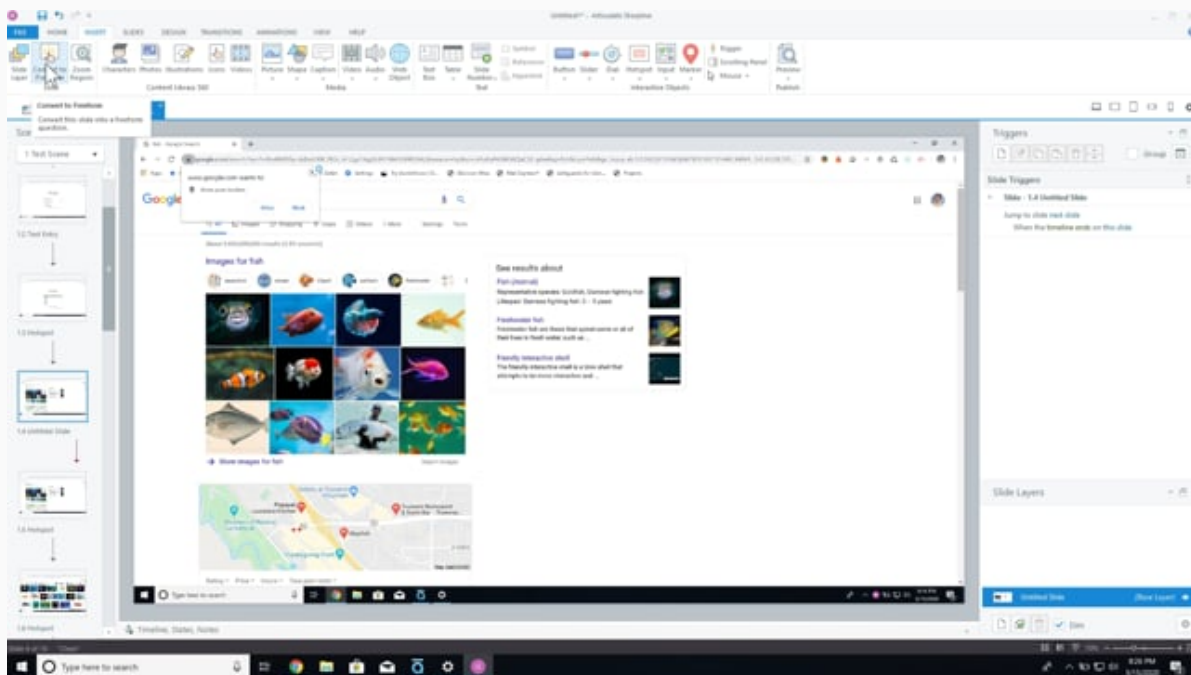


One last tip: when you create Try simulations, consider including ways that the student could possibly fail. Failing is part of learning; it can help the learner see what happens if they select various alternatives, as well as help them consider how they can recover from their mistakes.

Simulation—Evaluate

After the learner has watched a procedure and tried it out for themselves, you may need to ensure they know how to perform certain tasks. This is where the role of Evaluate simulations come into play. Evaluate simulations help both you and the learner judge if they are able to perform a task they have just learned. The most helpful evaluation simulations are ones that allow the user to fail and learn from their mistakes. The key here is to try to make the simulations as close to the real environment as possible. Video 3 shows you how to get started doing this.

Video 3: An Example of How to Create an Evaluate Simulation



Simulation—Play

The last type of simulation allows students to play with ideas or concepts associated with the instructional environment. Playing helps learners work with the knowledge they have gained in different, engaging ways. The goal is to help them take what they learn and apply it in novel ways so they are able to master it better. Let's walk through some important parts of a game.

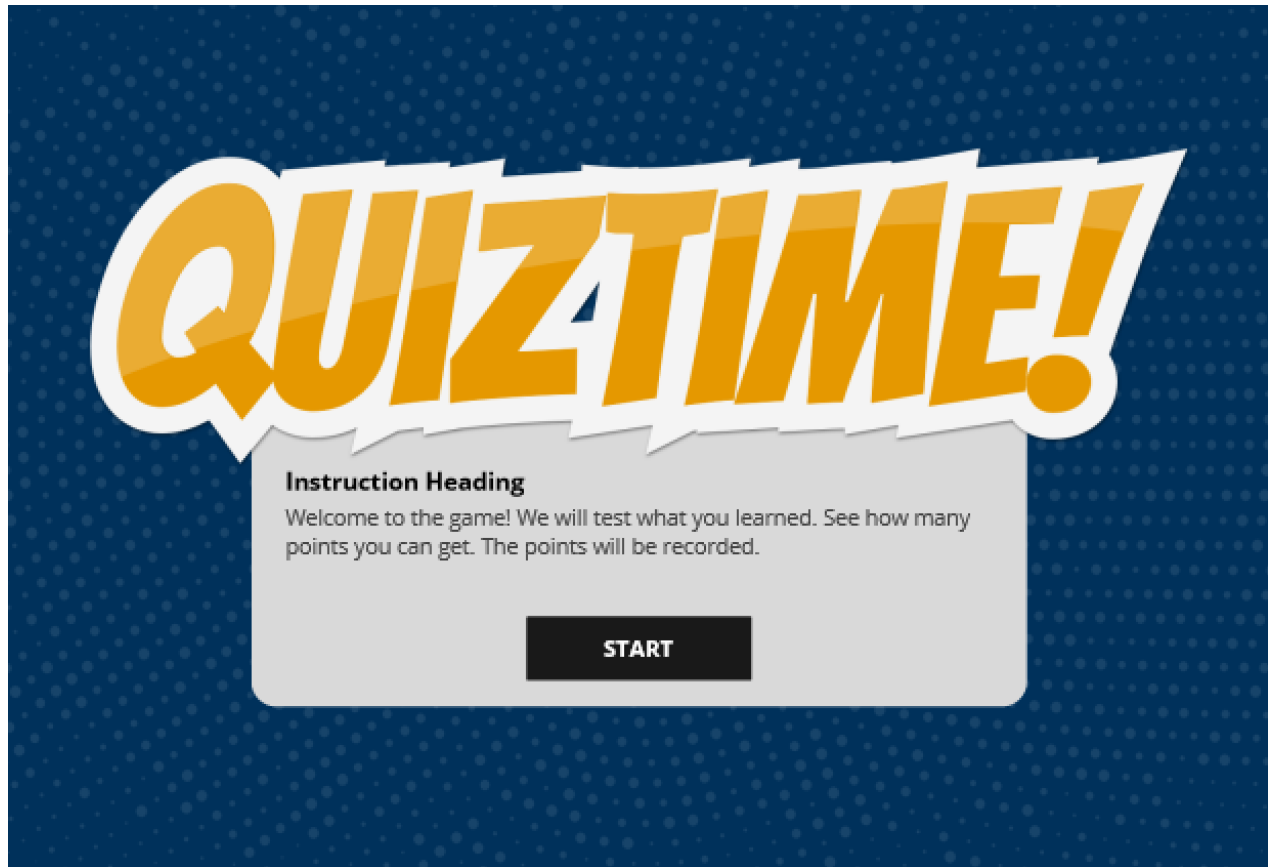
There are key factors that go into creating a learning game which enables this simulated play. I don't think anyone expects you to create a World of Warcraft type game, but there are some parts you can use to make the game stand out in an engaging and fun way for the learner. Some important considerations for Play simulations include: Theme, Progression, and Challenge. Consider each of these principles using the extended example below.

Theme

A theme is a unifying core to your game that helps express its purpose, and bring a sense of harmony between that purpose and the tone, visuals, audio, video, text, and other elements you create. To immerse learners into the game, introduce a theme as soon as possible, perhaps expressed by using a clever or unique logo. This helps the learner know they are exiting the standard instructional format and entering a gamified environment.

Review this Jeopardy-style game. Notice how a theme is introduced when the learner first begins the game, as are initially presented with a large logo that provides clues about what they will be doing.

Figure 1



Providing a theme has a couple of results. It sets the tone of the game through the logo and visuals that complement the logo. And the theme can help you tell the "story" of the game, or provide cues to the learners about how they should interact with the environment.

Progression

Progression is how learners move from the beginning to the end of your game, and how they navigate through the steps in between. Progression is a principle you could use in different ways. In the case of our Jeopardy game, the tool to manage progression is the game board.

Figure 2

Progression Screen



As the learner moves throughout the game, they clearly see where they have been along with what levels or cards were successful or unsuccessful.

Figure 3

Progression Screen Reflecting Progress



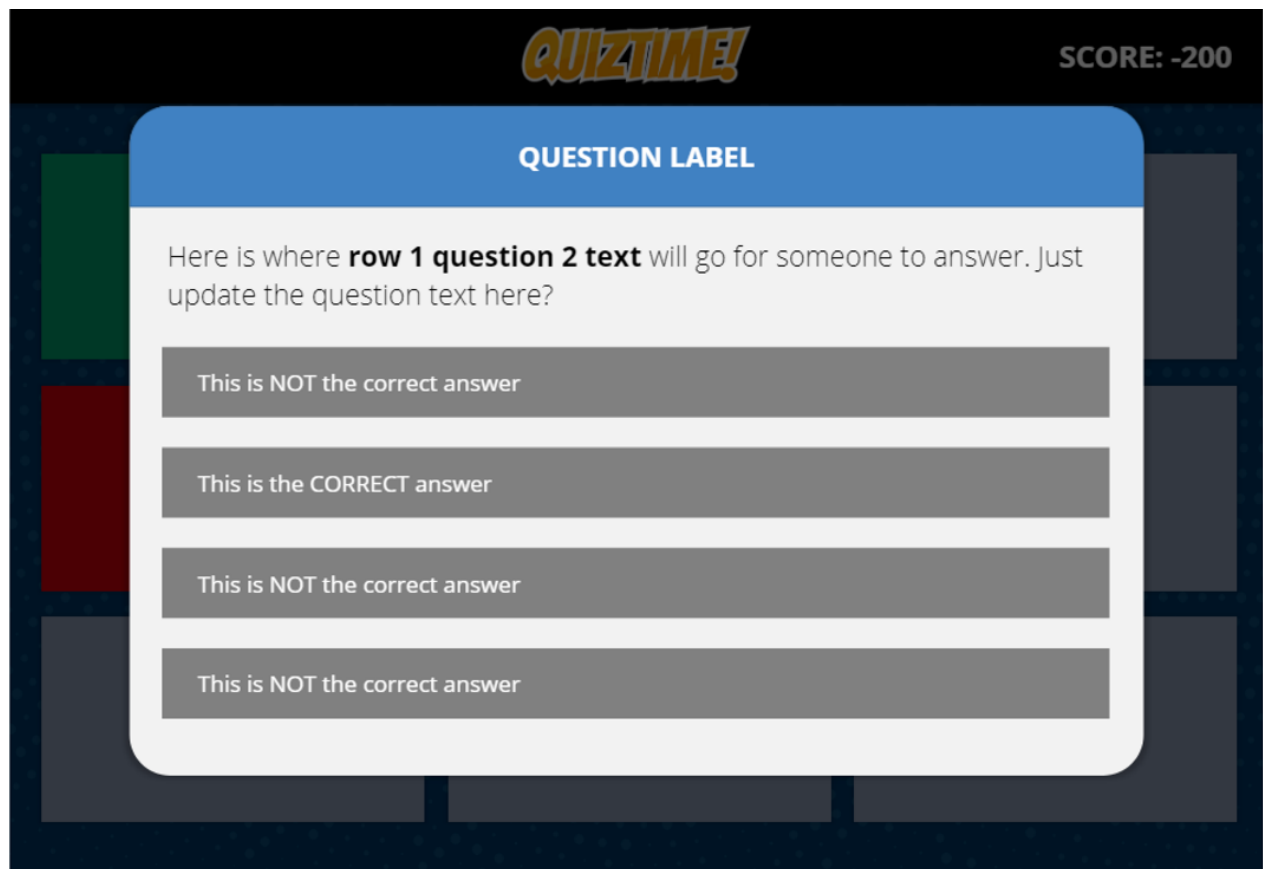
This type of progression tool is also helpful for the learner if they try the game again. They can use the progression board to gauge how they are doing each time they play.

Challenge

Challenges are how you present instructional content and allow learners to interact with that content. In our game, when the learner chooses options on our the progression board, they begin an individual challenge. These challenges can come in many different forms with varying levels of challenge between the tasks. One way to challenge the learner is through a standard question.

Figure 4

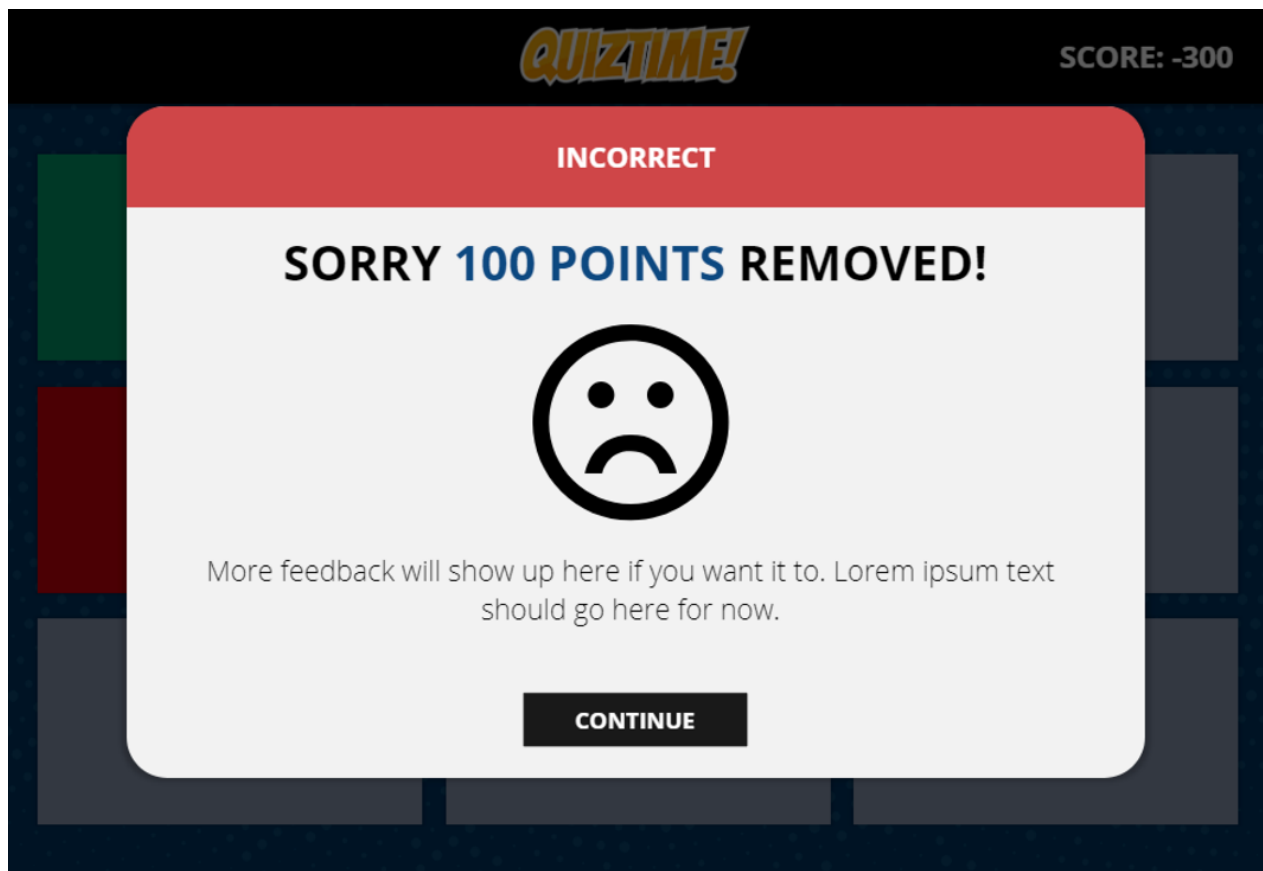
Standard Question



If the learner gets the answer incorrect, they will see some kind of visual indication, and perhaps some feedback.

Figure 5

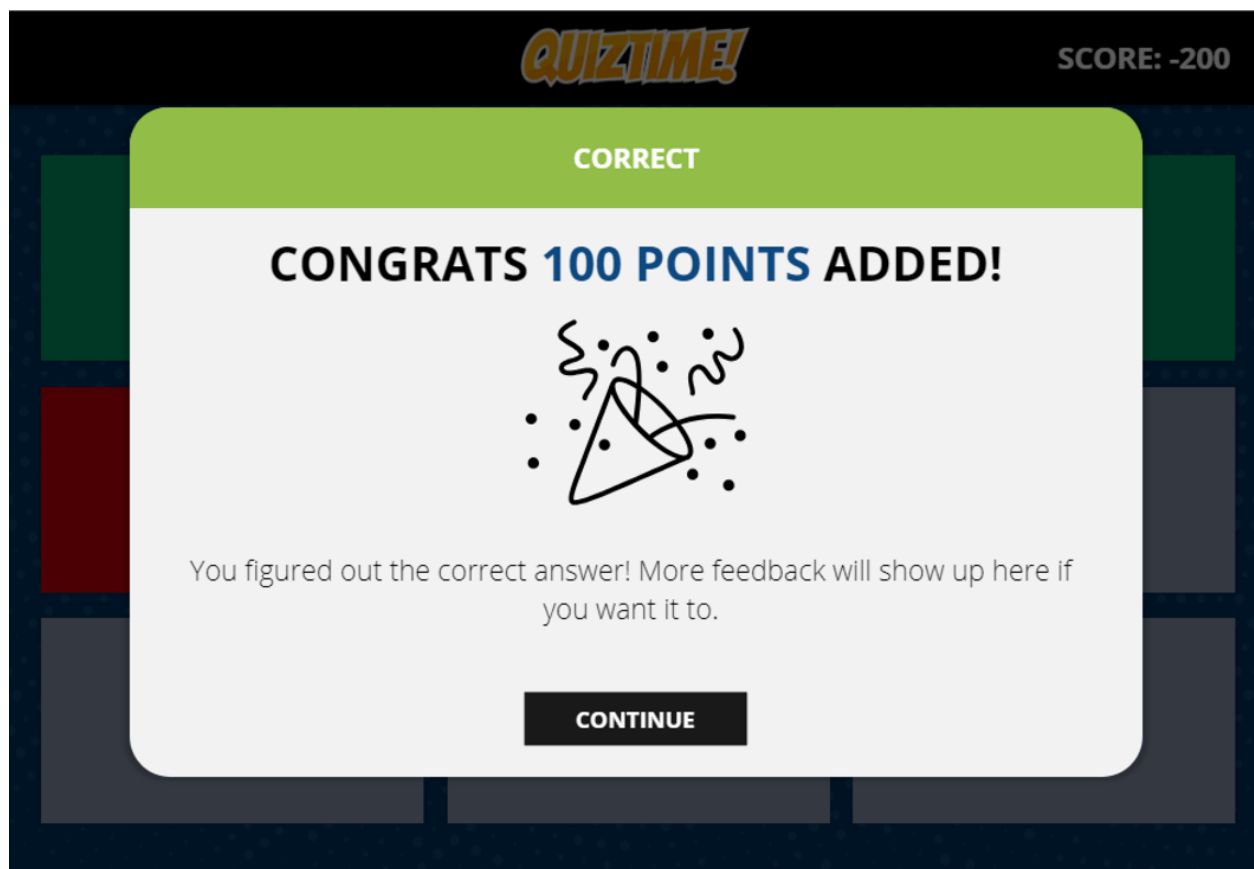
Feedback on Incorrect Answer



If the learner gets the question correct, they will see correct feedback.

Figure 6

Feedback on Correct Answer



But you can present challenges in ways other than through questions. You can also add some more ambitious aspects into each challenge, like having them try a procedure or a skill.

Also, since this is a game, you might want to have an overall score that is visible to the learner. When the learner gets the challenge correct, the score increases. To make it even more challenging, points could be taken away when the learner does not answer correctly. You could also add a timer or other sense of urgency for students to complete the game.

Managing Interactions in Simulations and Games

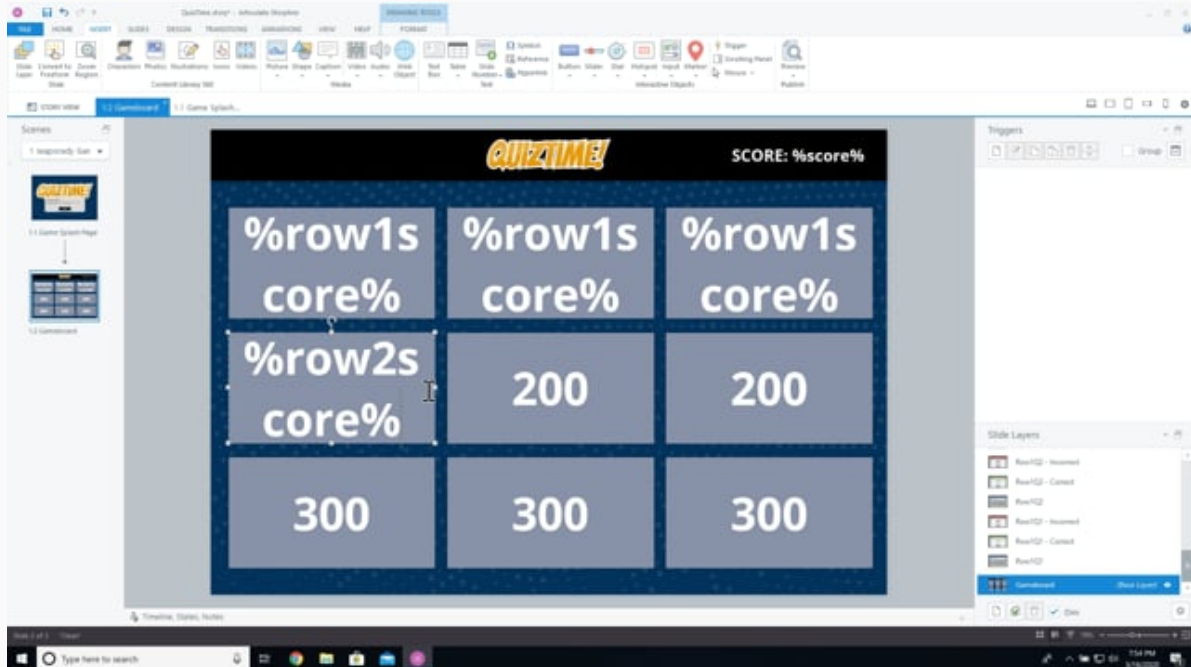
Simulations and games require you to manage interactions that students have with the program, such as when you have to pass information from one screen to another based on how students respond to a question. Three common ways of managing interactions you should know about are Variables, Triggers, and Conditions.

Variables

Variables are storage locations. They hold information that can change or be updated later. The most common type of variable for a game is the Number variable which will store a number value. This is perfect for scoring or being able to calculate end results in a final interaction. For instance, if you create a game with a score, you want to create a variable that holds the initial starting value (probably 0), but can then be changed depending on whether learners earn points or have them taken away.

Let's explore how to create a variable in this video in a common instructional authoring tool.

Video 4: Creating Variables

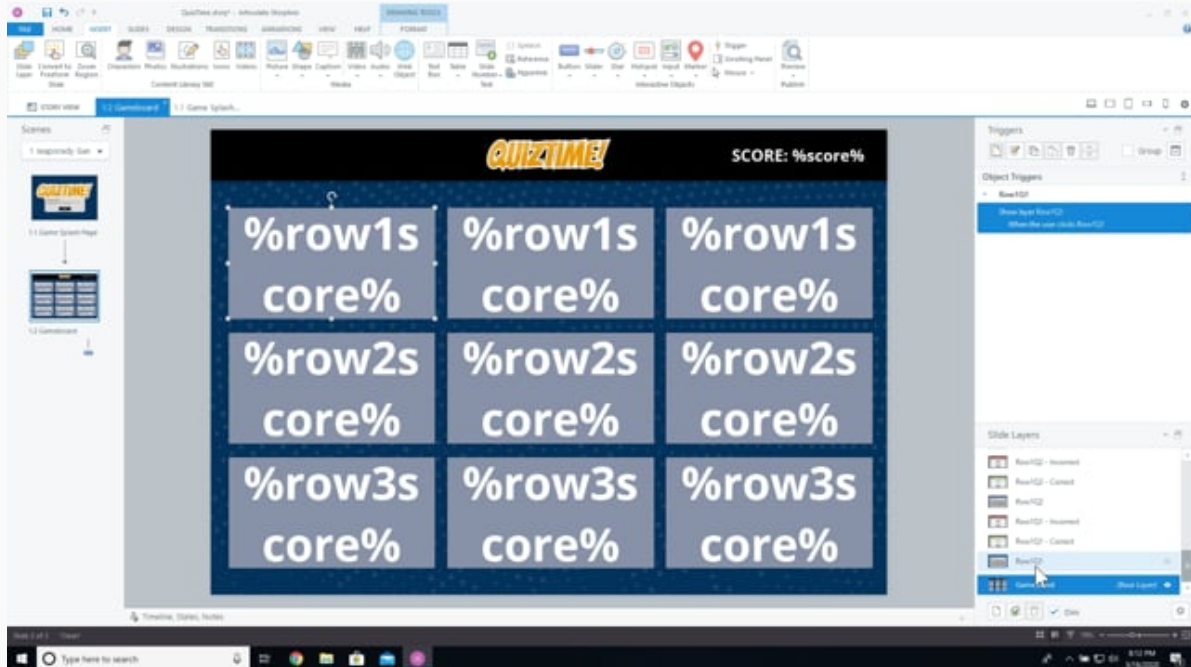


Triggers

Triggers are events that happen in a simulation. For instance, when a button is clicked, what should happen next? In many instructional authoring tools, you'll use triggers to show and hide different elements based on how learners interact with a page.

You have a lot of flexibility with triggers, and the key to adding different types of interactive play is to try out different types of triggers. Instead of only using standard questions in a game, for example, you can use drag and drop, timed elements, and more. This creates the interaction and intensity of simulated play.

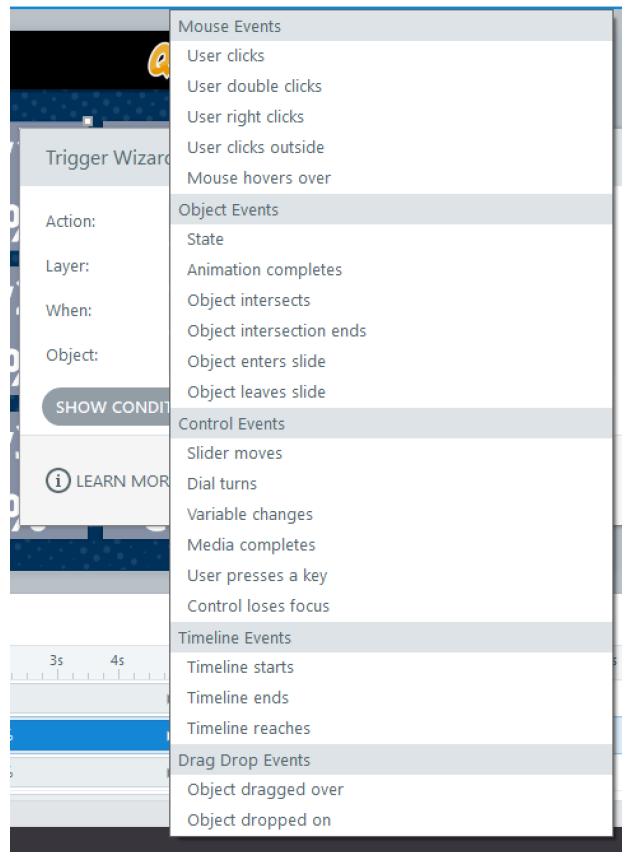
Video 5: Using Triggers



One key to using triggers is deciding when the trigger will happen. This is done under the "when" part of the triggers. Figure 7 provides a list of instances when a trigger can fire.

Figure 7

Trigger Selection Screen

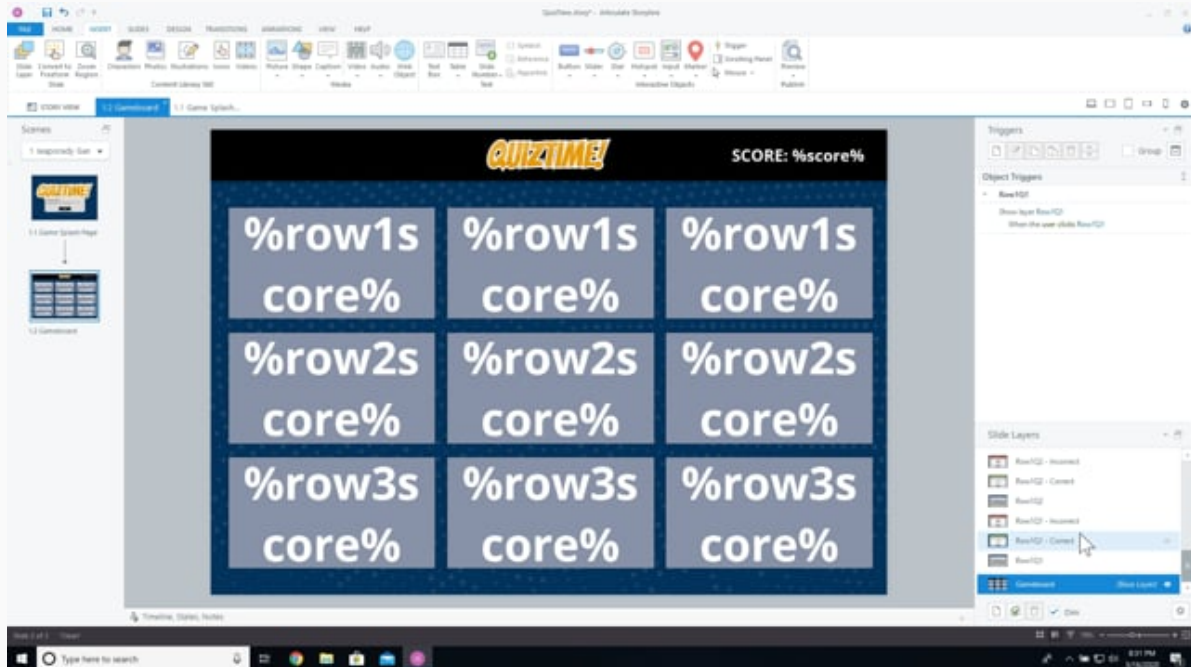


Conditions

Triggers are great, but there may be times you only want the trigger to happen if a certain condition is true. Consider the following statement: "If you're happy and you know it, clap your hands."

This is a simple statement, but it reflects so much of what a condition is. It starts with the key word if. Meaning, we only want this condition to happen if certain conditions are true, and the conditions are, "if you are happy and you know it." We are checking for two conditions, then running the action if the condition is true.

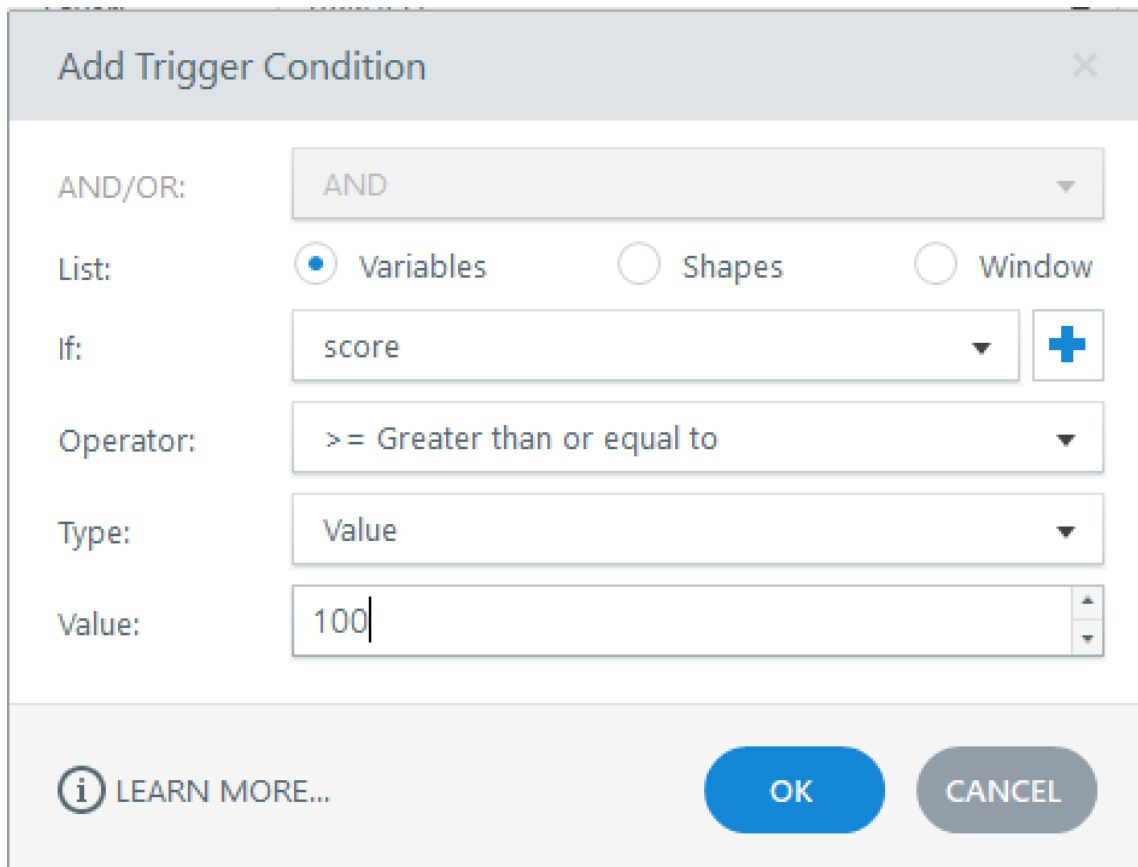
Video 6: Understanding Conditions



Most of the time you will use conditions when you are checking a variable value. So, with the Variable option selected, find the variable you are checking for and select the value. It will then ask you to select an operator. Let's use the score variable and check if it is greater than or equal to 100.

Figure 8

Trigger Condition Screen



Add Trigger Condition

AND/OR: AND

List: ☒ Variables ☐ Shapes ☐ Window

If: score +

Operator: >= Greater than or equal to

Type: Value

Value: 100

i LEARN MORE... OK CANCEL

Now this trigger will only run if the value is 100 or greater. This is a great way for you to only have triggers run if a condition is met.

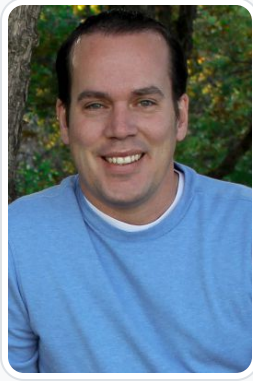
Conclusion

The goal of instruction is to help the learner first understand and then be able to apply what they are learning in safe and controlled environment. Simulations and games are great tools for doing this, allowing learners to test the new concepts before entering the real world, practice mastery through fun and engaging games, and try scenarios in an environment that allows them to fail and learn from their mistakes.

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Open Education

A/B Testing on Open Textbooks

The Interaction of Open Educational Resources (OER) Use and Course Difficulty on Student Course Grades in a Community College

Recognizing and Overcoming Obstacles of OER

Sharing and Self-promoting

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A/B Testing on Open Textbooks

A Feasibility Study for Continuously Improving Open Educational Resources

Royce Kimmons

Continuous Improvement

Textbooks

Testing

Open Textbooks

This study examined the feasibility of employing A/B tests for continuous improvement by focusing on user perceptions of quality of six chapters of a popular open textbook over the course of a year. Results indicated non-significant differences in all cases but also suggest that future work in this area should (a) employ A/B testing at a broader, less-granular (e.g., platform-level) scale to increase sample sizes, (b) explore autonomous approaches to experimentation and improvement, such as bandit algorithms, and (c) rely upon more universally collected dependent variables to reduce sample size limitations emerging from self-reports.

Introduction

Open educational resources provide great promise to instructional designers as low-cost, high-impact educational materials that can be used, shared, remixed, and adapted with ease. Especially when viewed through the lens of the “5Rs” of openness (Wiley, n.d.)—Retain, Revise, Remix, Reuse, Redistribute—or the lens of “expansive openness” (Kimmons, 2016), such resources give instructional designers the ability to create and share learning materials at a massive scale, to adapt existing resources for better meeting the needs of target learners, and to remix resources from various authors into multi-faceted and rich learning experiences.

Because of the ubiquity of textbooks in higher education, the open textbook as a medium promises to be a valuable means for providing learning opportunities to many students while also driving down costs. Students at four-year

universities in the U.S. currently spend an average of \$1,240 on textbooks per year (College Board, 2019), and textbook cost hikes have far outpaced inflation, consumer costs, and recreational book costs, making higher education opportunities more cost-prohibitive and requiring students to skip meals, enroll in fewer courses, and work longer hours (Whitford, 2018). While open textbooks provide an opportunity for universities to drive down student costs and to improve learning experiences, open textbooks are not widely used (Seaman & Seaman, 2018). This is presumably due to perceptions of time limitations emerging from tenure and promotion practices and perceptions that open textbooks are of relatively poor quality when compared to their copyright-restricted alternatives (Kimmons, 2015; Martin & Kimmons, 2020).

Though systemic challenges to open textbook adoption may be outside the realm of instructional designers to address, one clear way that we can make a difference is to help improve the quality of these resources. Some initial work has sought to establish quality metrics for open textbooks and other open resources (Bodily et al., 2017; Woodward et al., 2017), and Dinevski (2008) proposes that the quality control of these resources is relatively unique by placing accountability in the hands of learners, teachers, and local designers to address localized or demographic-specific needs, rather than upon market-driven publisher considerations. Furthermore, though traditionally published textbook editions are viewed as static entities that are either high- or low-quality, because of their live and open nature, open textbooks can also undergo continuous improvement efforts that iteratively improve their quality over time, correcting mistakes, refining formatting, and providing supplements as needed to improve learning (Wiley et al., 2021).

For these reasons, applying continuous improvement cycles to open educational resources is of increasing interest to designers, but we are only just beginning to figure out how to do this well, especially when large-scale data are involved and resources are being used by a wide array of learners. Borrowing from the software development field (the same field where the notion of openness came from, to begin with; Kimmons, 2016; Open Source Initiative, n.d.; Stallman, 2013), it seems reasonable to consider how modern approaches to software improvement might apply to educational resources as well. As a promising example, A/B or split testing is an approach to software development that places at least two different versions of a product in front of random sets of actual users and analyzes their behaviors over time to determine which is superior (Kohavi & Longbotham, 2017).

When it comes to education, A/B testing has been proposed not only as a process for improving design but also as a process for choosing between competing pedagogical methods or other decisions of educational importance (UpGrade, n.d.). In the case of open textbooks, A/B testing would require having at least two versions of content that users interact with. The “A” version (otherwise called the original version or control) represents the default version of the resource as originally created by the author, while the “B” version (otherwise called the experimental flight or fork) represents a variation of the resource that the researcher hypothesizes might yield differing behaviors or results. To make comparisons, audience size for each version may not need to be equal, and relative sampling for different versions may involve an assessment of the urgency and relative importance of experimental variations. As readers are assigned to the competing versions of the textbook, a variety of analytics could be collected to test which version is superior, and successive tests could theoretically be employed on the same resource to gradually improve it in many different ways.

Bringing these ideas together, this study explores the feasibility of using A/B testing to inform continuous improvement and increase the perceived quality of open textbooks. Relying upon data collection and analysis mechanisms of a popular open textbook for undergraduate and teacher education, the guiding research question of this study was “How feasible is it to conduct A/B testing on highly-used open textbook chapters for the purpose of improving perceptions of quality?”

Methods

To conduct this study, experimental flights were created within the EdTech Books system by copying six chapters as new flights (or “B” versions), adjusting their contents, and setting each chapter’s “Flight Mode” to “Automatic.” The automatic mode meant that whenever any reader navigated to the chapter, they were randomly assigned to either view

the original or the experimental flight. This assignment was done without the reader's awareness and ensured true randomization. Flight assignment was enabled for a period of 12 months (February 2020 to February 2021), and results were then analyzed to compare reader behaviors and perceptions for the time period. As a methodological note, though this timeframe coincided with the COVID-19 pandemic in many countries and resulting shifts to online and remote learning might have influenced overall usage of open resources, such a shift would not be expected to influence the types of user behaviors measured here between groups. For instance, though more people might have started reading the textbooks because of the pandemic, we would not expect this to influence the relationship between text size within the textbooks and reading behaviors. For this reason, we did not conclude that the targeted timeframe for the study should be considered as an additional variable or meaningful frame of analysis.

Context

EdTech Books is a free online publishing platform for open textbooks. Built with PHP, MySQL, and Javascript, the platform operates on four guiding values of freedom, accessibility, usability, and quality, providing authors with tools to easily create, remix, and share textbooks (Kimmons, n.d.). Currently, the platform provides content to roughly 50,000 unique readers per month, representing students, teachers, and the general public. Content is provided in simple HTML via web pages and also as PDFs for download, representing millions of page views over the course of its two-year lifespan.

Central to the mission and design of EdTech Books is the goal of supporting continuous improvement and improved perceptions of open textbook quality. Toward this end, the system provides A/B testing features, quality assurance mechanisms, advanced analytics, and various other tools to support ongoing analysis, adjustment, and improvement of materials. However, since the notion of continuous improvement is not commonly connected to the development of published materials, like textbooks, it is unclear how to do this well and how to develop systems that both empower and encourage authors to engage in this process.

For this study, I analyzed results from six experiments conducted within EdTech Books upon separate chapters of a popular open textbook: *The K-12 Educational Technology Handbook* by Ottenbreit-Leftwich and Kimmons (2020). This textbook has been accessed over 120,000 times in its short lifespan and is widely used for teacher education courses and professional development efforts and is also commonly accessed from search engine results on topics related to technology's role in education.

Participants

As readers accessed the textbook on the platform for the first time, they were notified that the system collects anonymous analytics related to their behaviors, and they were given the option to opt-out of being tracked in this way. For this study, I focused on opted-in reader data associated with this single textbook.

As with other textbooks in the platform, readers of the textbook accessed chapters in many ways but generally fell into two categories: (a) formal learners who accessed chapters from links or LMS embeds associated with official university courses and (b) non-formal or informal learners who accessed chapters from organic search engine results (e.g., those searching Google for "tech integration"). Backlink analysis of the textbook revealed that it was heavily used by students at a number of universities, including Brigham Young University, Marist University, Oklahoma State University, State University of New York, Montana State University, Purdue University, and others. The breakdown of formal vs. non/informal learners, however, varied from chapter to chapter with some chapters like "Technology Integration" experiencing a relatively even split between the two and others exhibiting high skew in one direction or the other. Even within these categories, we would expect to find great variation in reader goals, purposes, and activities, as higher education institutions use these resources for diverse courses. For the purpose of this study, reader type was not considered in data analysis, and the flight assignment procedure did not take reader category into consideration for random assignment, meaning that the demographics of both the original and experimental versions of each chapter would be expected to exhibit similar distributions of reader types to the overall chapter. This was an intentional design decision but assumes that optimal design decisions for improving perceived quality would not vary by reader category.

Dependent Variable

Because perceptions of poor quality are a major barrier to open textbook adoption and diffusion (Kimmons, 2016; Martin & Kimmons, 2020) and the improvement of perceived quality is a major goal stated on the platform, we constructed experiments with the goal of improving reader perceptions of quality, as measured by a simple survey. This single-question survey was provided as an unobtrusive “End-of-Chapter Survey” at the bottom of each chapter that asked the following: “Overall Quality: How would you rate the overall quality of this chapter?” Possible responses were coded to an ordinal scale as follows: (1) “Very Low Quality,” (2) “Low Quality,” (3) “Moderate Quality,” (4) “High Quality,” and (5) “Very High Quality.” The form was then automatically submitted as readers navigated away from the chapter or closed their browser tab, resulting in an average quality rating of 4.1/5.0 for the targeted textbook chapters ($n = 963$ ratings, $SD = .67$). Results also exhibited a strongly negative skew, with only 4 ratings (0.4%) falling below “Moderate Quality” (see Figure 1). These ratings represented results from 810 different users with the average user leaving 1.19 ratings across chapters in the book ($SD = .75$, $Max = 10$).

Figure 1

Distribution of Textbook Ratings

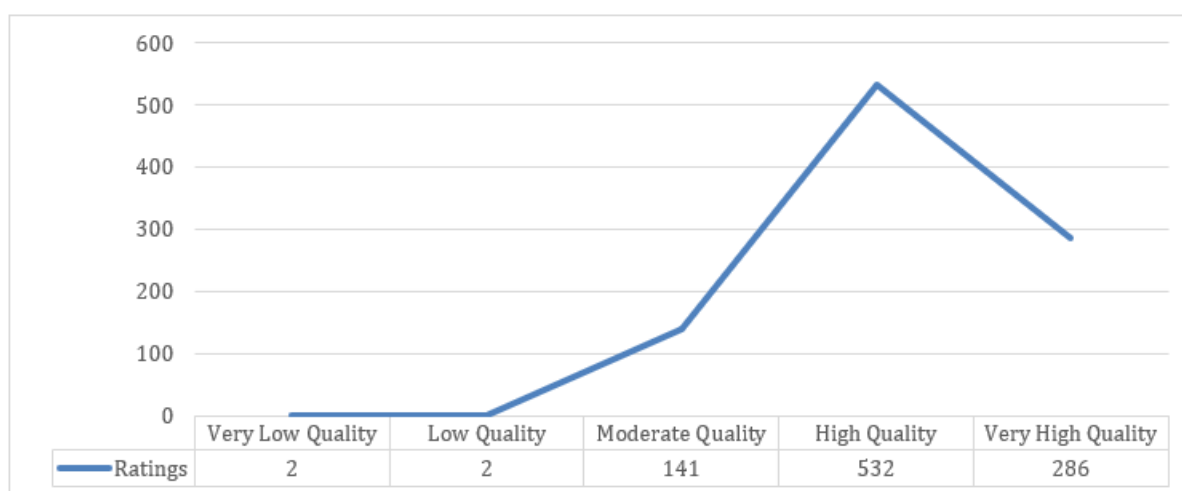


Chart showing the distribution of textbook ratings

The unobtrusive and optional nature of this survey helped to avoid Hawthorne effects in results and provided similar benefits to those found in the analysis of public internet data sources (Kimmons & Veletsianos, 2018), even though some interpretive power was lost with limited contextual information about readers. This approach also provided minimal risk, effort, and discomfort to users and prevented analyses from being classified as human subjects research according to NIH definitions, because the process (a) did not collect information about individuals and (b) did not include identifiable data, such as demographics, names, user type information (e.g., student vs. faculty), or IP addresses. This means that the sample size for each experiment was limited to those who anonymously answered the quality assurance measure at the end of the chapter, which accounted for around 1% of readers for each chapter.

Though such a low response rate would be troubling in some research settings, the fact that readers were randomly assigned to the two groups helps to alleviate concerns of self-selection bias, and low rates of response will always be a necessity when using unobtrusive measures of relatively free-roaming user activities like these. This point is of special importance when studying open resources, because most of the traffic (or user behavior) associated with these resources constitutes lurking (Bozkurt et al., 2020) or those who may briefly open the chapter without any intent to actually read it. To illustrate, Google Analytics reported that the bounce rate for the book in this time period (or the number of users who navigated away after viewing only one page) was 71.85% with the average user session lasting

less than 3 minutes. This is why, for instance, MOOCs have such notoriously low completion rates (Gütl et al., 2014; Rivard, 2013) and why when studying open environments and resources it makes sense to limit analyses to users whose behaviors suggest an intent to participate in the behaviors we are measuring (e.g., Veletsianos et al., 2021). Judging by user scrolling behaviors, time on page, textual length, and chapter text complexity for the target textbook, it is estimated that only about 22.7% of page views actually constituted a “read” of the contents, and among those who read the contents, there was no incentive or prodding to complete the end-of-chapter survey. Yet, such data should nonetheless be valuable for understanding user perceptions of resources in the same way that user ratings are valuable on sites like Amazon or Yelp to determine the quality of products or services, even if the relative representation of ratings is very small in comparison to the total number of customers on those sites.

Embedded automatically by the platform at the end of every chapter, quality assurance surveys provided results to authors in an “Analytics” dashboard at the flight, chapter, and book levels (see Figures 2 and 3). In the “Analytics” dashboard at the flight level, an additional table was also provided to authors that provides statistical comparisons between the original and the experimental flight (see Figure 4). These tables allowed authors to compare reader behaviors between the original and the experimental flight on the “Overall Quality” measure as well as embedded learning checks and surveys in the chapter. In the provided example, for instance, each row (except for the final “Overall Quality” row) represents a different learning check within the chapter, and the table reveals to the author whether the experimental flight influenced performance on the learning measure. Because these learning measures are chapter-dependent, they cannot be compared between chapters and will not be included in this study. However, common learning measures could be compared in future studies as readers are more likely to complete these than quality assurance surveys, thereby providing more robust sample sizes at a faster rate.

Figure 2

Screenshot of the Analytics Overview for a Chapter on EdTech Books

👍 Overall Rating	4.1/5.0 ★★★★★☆
👍 Total Ratings	253
📄 Page Views	19.0K
📄 Tracked Views ⓘ	20.7K
📄 PDF Downloads	443
💰 Cost Savings ⓘ	\$1.2K
👁 Reading Ease ⓘ	Very Difficult (28.1)
👁 Grade Level	12+
👁 Word Count	5,111
👁 Reading Time ⓘ	27 minutes
👁 Predicted Reads ⓘ	5.9K
👁 Reading Likelihood ⓘ	28%
✍ Last Updated	2020-06-28 17:28:21

Chart showing the analytics categories to evaluate a chapter on EdTech Books

Figure 3

Screenshot of a Chapter Quality Display for a Chapter

Selection	Votes
Very Low Quality	0
Low Quality	1
Moderate Quality	47
High Quality	133
Very High Quality	72

Screenshot Showing the Chapter Quality Ratings

Figure 4

Screenshot of a Flight Comparison Table

	Original			no stock photos			Change	Welch t-Test	p- value	Cohen's d
	Mean	n	SD	Mean	n	SD				
teacher-values	1.37	336	0.82	1.46	270	0.85	0.09	1.32	NS	0.13
networked- thinking	0.72	410	0.69	0.78	308	0.55	0.06	1.35	NS	0.16
stimulus	0.81	389	0.58	0.78	299	0.65	-0.03	-0.69	NS	0.09
inner-workings	0.74	386	0.71	0.77	298	0.7	0.03	0.49	NS	0.05
prior- experiences	0.75	379	0.6	0.81	298	0.54	0.05	1.22	NS	0.17
tech-admin- values	1.6	331	0.68	1.64	261	0.65	0.05	0.89	NS	0.11
principal- values	0.96	332	0.84	0.97	259	0.83	0.01	0.12	NS	0.01
pck	0.69	327	0.67	0.63	256	0.81	-0.06	-0.99	NS	0.11
pic	0.81	331	0.65	0.85	255	0.63	0.04	0.76	NS	0.1
rat	0.94	333	0.36	0.91	256	0.43	-0.02	-0.68	NS	0.14
usefulness	3.93	336	0.96	3.89	266	0.93	-0.04	-0.49	NS	0.04
Overall Quality	4.09	256	0.7	4.19	195	0.63	0.11	1.66	NS	0.23

Chart showing a flight comparison table

Independent Variables

To improve perceived quality of the targeted chapters, format- and content-based experiments were created for six different chapters in the textbook, with each experimental flight representing a different variable to be tested. When creating learning content, design decisions are highly contextual. For instance, there is no consensus in the design research literature on whether video is useful for learners simply because the answer depends so much upon contextual factors—such as (a) the type of video, (b) the quality of video, (c) its relationship to the text, (d) the age and characteristics of the learner, etc.—and even proposing decontextualized design decisions that are intended to be universally applied (like “what are the effects of video on instruction?”) has come to be viewed as a misguided or altogether confounded research strategy (Honebein & Reigeluth, 2021). The alternative to this is to employ research efforts in iterative, continuous improvement where a variety of strategies might be tested in deeply contextualized ways to improve learning products, such as adding or removing a specific video to a live textbook chapter. Toward this end, this study focused on six chapters in a single textbook and experimentally tested a different design change for each chapter (representing two versions of each chapter) to determine the feasibility of testing and revising these kinds of design decisions on-the-fly with live products. For instance, in the “Technology Integration” chapter, the experimental flight removed stock photos to determine whether the mere presence of photos influenced perceptions of quality. Similarly, in the “Lifelong Learning” chapter, the experimental flight removed an introductory video for the same purpose. Other changes made to remaining chapters included (a) adding extra images (for “Information Literacy”), (b) removing direct illustrative quotations (for “Online Professionalism”), (c) increasing the font size (for “Online Safety”), and (d) changing the sans-serif font style to a serif font (for “Universal Design for Learning”). In every case, chapters were set to “Automatic” flight assignment for a one-year period, and a series of Welch’s t-tests were conducted to determine whether the change influenced overall quality ratings for the chapter in the target time period.

In constructing these experiments, we did not expect to see drastic differences in results, but we did anticipate that if we could identify small formatting or content changes that resulted in small quality differences, then as these changes were aggregated together and applied to the entire textbook, overall quality could be improved in meaningful ways. For instance, even if adjusting stock photos, fonts, or videos only affected less than a 10% change each in perceived quality, by applying these results to all of the chapters we hoped to be able to improve chapters in ways that would show significant aggregate benefit. Additionally, because all of these experiments reflected relatively low-cost adjustments to resources that are used by a large number of people, even small improvements would be expected to have considerable relative advantage. For instance, if a small change can improve readability by only 1% of a textbook with a readership of 50,000, that small change could mean that 500 more people might actually benefit from the resource. Thus, though small improvements may historically be treated as insignificant in educational settings that are constantly seeking after silver-bullet or 2-sigma solutions (e.g., Bloom, 1984), when we move into the realm of high-impact open resources that we can adjust at low-cost, even tiny improvements can yield drastic results in learning for the broad population.

Results and Discussion

The simple result of this study is that after one year of constant data collection on a popular open textbook, all experiments came back as having statistically non-significant effects on perceived open textbook chapter quality. It is no secret that educational research exhibits a strong bias against reporting null effect studies, which leads many researchers to not publish valuable work and contributes to “publication bias, a positively skewed research base, and policy and practices based on incomplete data” (Cook & Therrien, 2017, p. 149), but even though results for this study were non-significant, the results may nonetheless be valuable for informing ongoing research and practice with continuous improvement efforts and open educational resources.

Table 1 provides a summary of the results for all six experiments, and there are at least two items of interest from the results that seem noteworthy. First, though non-significant, the Cohen’s d values for several of the experiments approach levels that suggest mild to moderate strength (e.g., $d = .58$ in the case of removing the introductory video for “Lifelong Learning,” and $d = .45$ in the case of switching to a serif font for “Universal Design for Learning”). Though we

cannot say for sure, these values suggest that with a larger sample size we might see effects that could mildly influence overall chapter quality perceptions, let alone aggregate effects.

Table 1

Results Summary of A/B Test Experiments for Specific Chapters

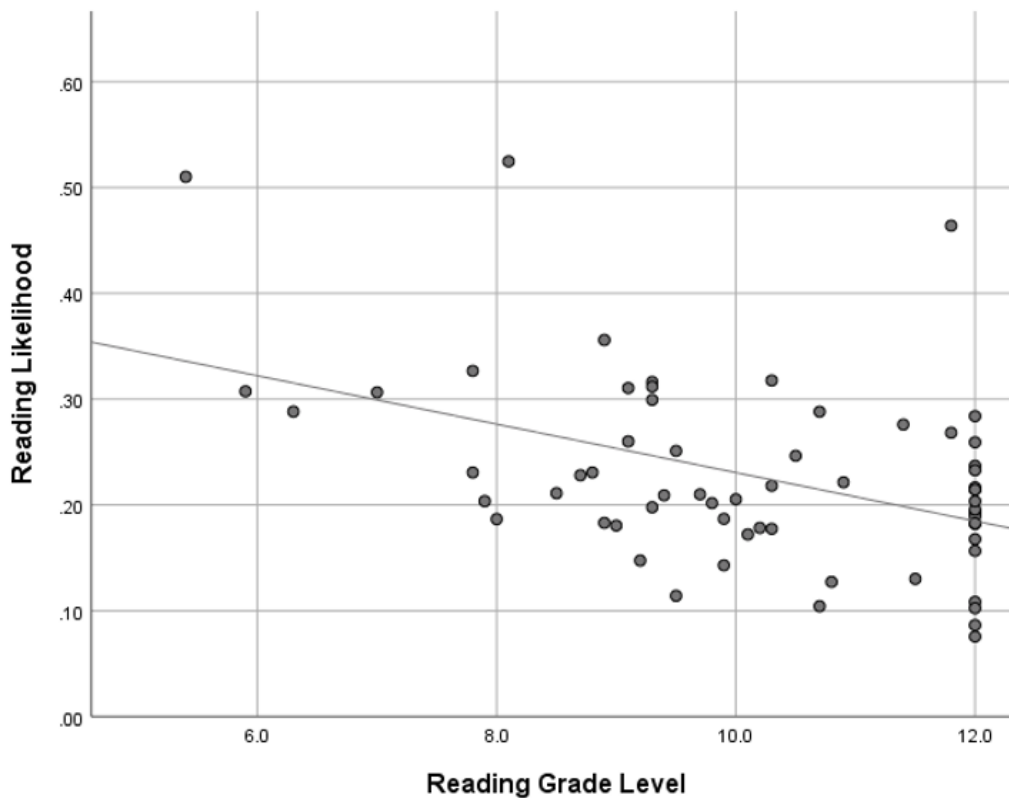
Experiment	Original Version (A)			Experimental Flight (B)			Change	Welch's t-Test	p-value	Cohen's d
	Mean Rating	n	SD	Mean Rating	n	SD				
Remove Stock Photos	4.09	256	0.7	4.19	195	0.63	0.11	1.66	NS	0.23
Remove Intro Video	4.19	70	0.66	3.95	44	0.6	-0.23	-1.92	NS	0.58
Add Extra Images	4.16	56	0.73	3.98	49	0.65	-0.18	-1.34	NS	0.38
Remove Quotations	4.26	100	0.73	4.16	88	0.6	-0.1	-1.04	NS	0.23
Increase Font Size	4.21	78	0.72	4.2	45	0.62	-0.01	-0.04	NS	0.01
Serif Font Style	4.09	58	0.7	3.88	24	0.67	-0.21	-1.29	NS	0.45

Building off of this, the second noteworthy element is the seemingly small sample size for each experiment. Though I explained this phenomenon and provided justification for why we might not expect larger sample sizes from free-roaming user behaviors above, the difficulty that this places on using these data for continuous improvement is that we seem to need an absurdly large amount of reader activity in order to collect a sufficient amount of optional self-report data for reliable testing. However, these results suggest that doing such work is feasible but that it just takes time and lots of data, especially when data are collected in unobtrusive ways and focus on user perceptions rather than discrete behaviors. Using the “Technology Integration” chapter as an example, only 1.2% of original version readers and 2.0% of experimental flight readers answered the quality survey, which means that even though tens-of-thousands of users read the chapters, we still were not able to rely upon these users’ data to provide sufficient evidence for improvement. This is further exacerbated by what is likely the low effect that each of these factors (on their own) has on overall perceptions of chapter quality, because smaller effects will require larger sample sizes to prove significance, and if we are only conducting experiments that we expect to have small effects, then even relatively large datasets may leave us wanting for significance. Furthermore, if these data were to be used in ongoing continuous improvement efforts, authors and researchers would find themselves in the predicament of having to throw out previous data every time they made an iterative improvement, because the original version would no longer be a valid control. The upshot of this reality is that even with a large reader base, using optional self-report data to improve open textbooks may not be a feasible approach to continuous improvement (at least not until the reader base reaches hundreds of thousands of users or more), making it difficult for most authors to make meaningful, data-driven improvements to their textbooks.

To address both of these issues, future research and development efforts would likely benefit from three key practices. First, rather than doing testing at the individual chapter or even book level, these sorts of tests might best be explored at the platform level where flights are created on all content to test for small changes. For instance, instead of removing stock photos on only the “Technology Integration” chapter, running a platform-wide flight of all chapters and programmatically removing stock photos for randomly-selected users would allow platform developers to determine the value of stock photos for EdTech Books users broadly with comparative swiftness. Similarly, doing a site-wide analysis of the effect that textual complexity has on reading likelihood reveals that likelihood goes down as complexity goes up, suggesting that as authors write chapters they should generally aim to simplify language (see Figure 5). The trade-off with this platform-level approach is that it would lose context, because not all chapters might benefit equally from the presence or lack of stock photos due to different content and audiences and some content might require greater textual complexity, but it would at least provide platform developers with data-based guidelines to provide suggestions to authors on what effects their decisions might be having on readers (e.g., “including more than three stock photos is predicted to reduce user quality perceptions of your chapters by 11.5%”).

Figure 5

Relationship Between the Reading Grade Level of Chapters and Reading Likelihood



Picture of a Chart Showing the Relationship Between the Reading Grade Level and Reading Likelihood for Chapters

Note. $R^2_{\text{Linear}} = 0.199$

Second, many of these types of tests can potentially become automated not just at the random assignment phase but also at the implementation and continuous improvement phase. For instance, if a font size experiment was implemented across an entire platform with a font-size increment of 10%, the system could create an experiment that increases font size for random users by 10% while reducing it by 10% and leaving it the same for others. This site-level test could continue until enough data were collected to determine which of the choices was optimal. In probability theory, this type of approach is called a “bandit algorithm” as it attempts to address the “multi-armed bandit problem” by maximizing positive outcomes (e.g., chapter reads, positive ratings) while simultaneously employing an exploratory mechanism to discover whether other options or features might improve results (Berry & Fristedt, 1985). Employing bandit algorithms for improving any design feature could utilize an infinite number of variables (e.g., different font sizes, types, or colors) in experimental ways that both produce actionable results and minimize undesirable outcomes. For many design decisions, this could allow continuous improvement to occur in an automated fashion without the need for authors or even developers to manually adjust designs to respond to experimental results. Rather, the design of the platform could become self-correcting in many regards to account for ongoing user behaviors.

And third, though relying on self-report data like quality ratings may still have a place (especially in larger scale analyses), more granular and faster improvements would need to rely upon unobtrusive user behavior data that is more universally collected. For instance, based on the textual complexity of a chapter and the time-on-page behaviors of a reader, we can determine whether each user actually read the page. Using this as the dependent variable would mean that we would have reliable experimental data for all learners rather than just the small subset that self-report data provides and would allow us to predict how experimental changes are affecting behaviors for all learners (e.g., does

changing the font style influence the likelihood that a user will read the page?). Though this may limit our experiments in some ways, it would allow for rapid and continuous improvement (especially when coupled with the other suggestions above) that would not be readily possible while waiting for self-report data.

Furthermore, many of these possible dependent variables would likely be correlated to one another. For instance, conducting a simple post hoc bivariate correlation of quality measures, predicted reads, and textual complexity on all chapters in the platform with at least 10 quality ratings ($n = 63$) revealed a significant, moderate relationship between these variables (see Table 2). This suggests that even if the primary goal is to improve perceived quality of textbooks, movement toward this goal might be accomplished in part by engaging in efforts that seek to influence more easily measurable variables (like reading likelihood).

Table 2

Bivariate Correlations of Chapter Factors

	Textual Complexity	Reading Likelihood
Quality Rating	.526**	.288*
Textual Complexity		.415**

* Denotes significance at the $p < .05$ level.

** Denotes significance at the $p < .01$ level.

Conclusion

In conclusion, though the experiments presented in this study yielded non-significant results, findings remain valuable for helping researchers and authors interested in engaging in data-driven continuous improvement efforts for several reasons. First, this study points out the relative difficulty of engaging in these efforts at a granular level (e.g., at the chapter or resource level), especially when the resources that we are seeking to improve do not enjoy viral popularity. Rather, such efforts are likely best addressed at the system level where experimental flights may be created with, randomized for, and aggregated from many different resources at once. Second, due to the relative simplicity of many of these experimental conditions, platform developers should explore automating not just the randomization aspect of A/B tests but also the actual implementation and experimental creation of tests, allowing the system to iteratively experiment-improve-experiment in valuable directions by employing bandit algorithms. And third, because these efforts rely upon unobtrusive data collection, continuous improvement will most effectively be influenced by data that can be collected from as many users as possible without relying upon low-probability participation metrics such as prompting users to answer a survey or to provide a rating. Incorporating these suggestions into any open textbook continuous improvement effort would offer great promise for making the most of user experience data that is readily available in many open platforms today. By doing so, the theoretically achievable goal is to create continuous improvement systems that are not only comparable to traditional publishing mechanisms but that far exceed them in ensuring the usefulness, usability, and perceived quality of open resources.

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The Interaction of Open Educational Resources (OER) Use and Course Difficulty on Student Course Grades in a Community College

John Hilton, Virginia Clinton-Lisell, & David Wiley

Open Educational Resources

OER

course difficulty

student grades

Zero Textbook Cost

Students report that not being able to afford course materials has adverse academic consequences. It is possible that this would be more problematic in relatively more difficult courses. Open Educational Resources (OER) are teaching and learning materials that are openly licensed and often available at low or no cost to students. This study examined the interaction between OER use through a campus zero textbook cost (ZTC) initiative and course difficulty on student course grades from 35 different courses at a community college while controlling for student gender, previous grade point average, and Pell grant eligibility status. Although the main effect of increasing course difficulty is decreasing individual students' grades, there was a significant interaction between OER use and course difficulty. Student grades in sections using OER declined at a lower rate compared to the decline in student grades in sections without OER use. The findings indicate that one particular context, course difficulty, may be important for understanding the efficacy of OER adoption.

Introduction

A community college in Virginia, USA, has developed a ZTC degree in which it is possible to complete all coursework for the degree with zero textbook costs. The term ZTC simply emerged from how sections of courses are listed in the course schedule. Some sections of courses require a commercial textbook and some sections of the same courses utilize OER. Sections that use OER are labeled in the schedule with a lowercase "z" beside the section number. Because many courses have multiple sections – some which require either commercial textbooks and some which use OER, it is possible to analyze potential differences in outcomes controlling for student attributes and estimating interaction effects with course attributes such as course difficulty. This study was conducted to test such course outcomes and interactions.

Review of Literature

Most college instructors require students in their courses to obtain learning materials (Seaman & Seaman, 2017 (<https://www.onlinelearningsurvey.com/oer.html>)), and the price of commercial learning materials, particularly textbooks, has increased dramatically in the past few decades (US Bureau of Labor Statistics, 2016 (<http://www.bls.gov/opub/ted/2016/college-tuition-and-fees-increase-63-percent-since-january-2006.htm>)). An alternative to expensive commercial materials are Open Educational Resources (OER), which include a variety of available learning materials such as textbooks, music, and videos that are licensed without access fees (Butcher, 2015 (<http://oasis.col.org/handle/11599/36>)) and are openly licensed for retention, reuse, revision, remixing and redistribution.

The COUP framework (i.e., Cost, Outcomes, Usage, and Perceptions) has been used to evaluate OER (Bliss et al., 2013). Beyond estimates of costs and savings (C), usage (U), and perception (P), a critical aspect to consider are the outcomes (O). If students save money, usage is widespread and nuanced, and perception is favorable, but student learning is not on par with the use of traditional textbooks, then the benefit of OER is diminished.

Most studies of OER outcomes have shown that courses using OER have comparable learning outcomes with courses using traditional textbooks (e.g., Clinton & Kahn, 2019). Sometimes the outcomes for OER are better and occasionally they are worse. Reviews by Hilton (2016, 2019) concluded that students generally achieved the same learning outcomes in classes with OER, compared with students in classes with non-

OER. Robinson (2015) utilized a quasi-experimental design to compare student learning outcomes between sections in the treatment group (OER) and sections in the control group (non-OER) among seven different courses. Overall, five sections using OER showed similar or better outcomes than sections of the same courses using traditional textbooks. Two sections of courses showed better outcomes using traditional textbooks. The same mixed pattern can be also found in a multi-institutional study by Fischer et al. (2015). The authors utilized propensity score matching to control for age, gender, and minority status in 15 courses. Each course had sections that used either a traditional textbook or OER. The majority of courses (10) showed no difference in student grades according to OER vs. traditional textbook used. Four courses showed better grades in OER sections and one course showed better grades in the section using the traditional textbook.

A meta-analysis that aggregated findings from 22 studies with a combined total of over 100,000 students in which OER textbooks were compared to traditional textbooks found that learning outcomes were equivalent (Clinton & Kahn, 2019). However, there was substantial variability across studies in effect sizes of learning outcomes between OER vs. non-OER. All of the studies used quasi-experimental designs with varying levels of control for possible confounds, such as being taught by different instructors. The authors grouped the studies for three potential methodological confounds: whether or not there was the same instructor, whether or not the same learning measurement was used to measure outcomes, and whether or not prior knowledge or academic achievement was accounted for in the findings. The findings on learning outcomes did not vary based on whether those potential confounds were accounted for. Therefore, it is uncertain why there was so much variability in learning outcomes across studies. However, when considering the relatively small effect sizes attributed to textbooks in general (Robinson 2015) and the typically low coefficients of determination, it becomes apparent that variability in student performance is associated with myriad unmeasured covariates.

The access hypothesis provides a useful understanding of the meta-analytic findings on open textbook adoption. According to the access hypothesis, having access to learning materials would be advantageous to learning outcomes; however, the number of students who would not have access to commercial resources but whose learning would benefit from access is relatively small (Grimaldi et al., 2019). Therefore, the effect of OER adoption on learning outcomes averaged across all students in all courses is likely to be null, as was found in the meta-analysis by Clinton and Kahn (2019). However, Grimaldi and colleagues (2019) commented that it is important to consider how different contexts may vary the outcomes of OER adoption, which is also evident by the large variability in effect sizes in Clinton and Kahn (2019).

One area in which the context interacted with OER adoption on learning outcomes was with student socioeconomic status. Two studies on OER adoption found that students who were eligible for a certain type of financial aid based on low-income status (Pell grants) benefited from OER adoption more than their peers (Colvard et al., 2018; Delgado et al., 2019). This is consistent with the articulation of the access hypothesis by Grimaldi et al. (2019) because students who had less income likely had fewer financial resources for course materials than their peers and may have been less likely to access pricey commercial resources, but could access the OER available without fees. Their peers may have been able to afford the commercial materials and received less benefit from OER adoption because they were able to access both commercial resources and OER.

There has been some examination of different contexts for outcomes of OER adoption. No extant study has examined how course difficulty may relate to OER and student learning outcomes. Approximately one-third of students in a study reported that not having the textbook due to cost had negative academic consequences (Florida Virtual Campus, 2018). Perhaps the use of OER in more “difficult” courses has a differential effect on outcomes because the potential effects of not having a textbook would be greater with more challenging courses. Granted, what is difficult for one student might be quite easy for another. Rather than stereotype departments and courses as difficult or easy, we acknowledge the fit between student interest and talents and the courses they complete. Nevertheless, some reasonable estimate of course difficulty might be important to consider in estimating the outcomes associated with the presence of OER.

Researchers have tried various approaches to estimate course difficulty but have mostly relied on perceptions of students or researchers. Ridley et al. (2003) used the perceived severity of grading standards to estimate intellectual challenge and course difficulty. Similarly, Bassiri et al. (2003) used grading policy in syllabi to estimate course difficulty. Babad et al. (2008) estimated course difficulty by analyzing perceived workload from course syllabi. Interestingly, Ansborg (2001) used student expectations of grade distributions to estimate course difficulty, where the logic was that a course that was of appropriate difficulty would have a negatively skewed distribution of grades. They expected that grades would generally be on the high end with few low grades in the class. The students’ expectation was that more difficult courses would have a normal distribution around a mean of 2.0 with fewer A grades. The idea of using distributions of grades seemed to be a reasonable approach to quantitatively estimate course difficulty. Indeed, Anderson et al. (2018) estimated course difficulty using historical grades and withdrawal rate in two finance courses (two sections each). While the withdrawal rate did not accurately discriminate between the two courses, the historical grade distributions seemed to be an appropriate discriminator. Wladis and Hackey (2014) estimated course difficulty simply by distinguishing between “lower level” courses and “higher level” courses based on the presence of credit-bearing pre-requisites. If a 200-level course had a credit-bearing pre-requisite, it was deemed to have higher difficulty. The authors did not find a significant effect of online versus face-to-face delivery on retention rates in higher level courses.

In addition to examining how OER outcomes may vary depending on context, another area in need of development is controlling for confounding variables. Because of the pragmatic realities of conducting research with college courses, quasi-experiments comparing naturally occurring groups (students enrolled in different courses) are typically the methodology used. This methodological approach allows for ecologically valid comparisons because real students in real courses are examined. However, the lack of random assignment in quasi-experiments limits the likelihood the compared groups were similar in important characteristics such as demographics or prior academic achievement. For these reasons, Clinton’s review of OER in psychology courses (2019) called for better control of potential confounds as this lack of control is a valid critique of OER efficacy research (see Griggs & Jackson, 2017; Gurung, 2017). Indeed, Clinton (2018) found that differences in prior academic achievement likely explained differences in learning outcomes when comparing an introduction to psychology course with a traditional textbook to one with an OER textbook. Some studies have controlled for possible confounds. For example, Fischer et al. (2015) used propensity score matching to control for age, gender, and minority status across all courses. In addition, Jhangiani et al. (2018) measured prior knowledge preceding the study and found that students in different courses had comparable background knowledge.

The current study was a test of the interaction between OER and course difficulty in a robust sample of courses and students while controlling for potential confounds. The primary research questions were:

1. What is the association of textbook type with students' course grades controlling for gender (self-reported), Pell grant eligibility (as a proxy for student socioeconomic status, see Colvard et al., 2018, for a similar approach), prior academic success, and course difficulty?
2. Does the association of textbook type with students' course grades vary with course difficulty? Prior academic performance is particularly important to control for because it is such a strong predictor of performance on learning assessments (Cassidy, 2015).

Method

The study was conducted in a community college in Virginia that has adopted an OER-based pedagogy that allows students to earn associate degrees with zero dollars spent on textbooks (DeMarte & Williams, 2015; Wiley, Williams, DeMarte, & Hilton, 2016). Data were obtained from 35 courses, which had both non-OER and OER sections, offered during the summer and fall semesters of 2016. Those courses were taught by 388 instructors. Some of the instructors taught courses or sections in the ZTC degree with OER and also taught courses outside of the ZTC degree with traditional textbooks. The courses included a wide range of subjects including business, mathematics, computer programming, biology, chemistry, history, music, and sports, which was a representative list of courses offered in a community college. Approximately 25,117 course grades were included but with listwise deletion of data based on the eventual covariates considered, 15,633 course grades were considered. Data were extracted from the college's archives.

The dependent variable, Course Grades, estimated students' learning outcomes and were reported on a five-point scale, A, B, C, D, and F (4,3,2,1,0). Five independent variables were included in the study: OER Course (Yes/No), Gender (Male/Female), Pell Eligibility (Yes/No), Course Difficulty (continuous) and Previous GPA (continuous).

OER Course was measured as a binary variable with 1 being OER course and 0 being non-OER course. Self-reported gender in the system was binary, male and female. Pell eligibility (1: eligible; 0: not eligible) and prior GPA were extracted for each student from the college's records. Prior GPA was standardized to a z-score, which has a mean of 0 and standard deviation (SD) of 1 (original mean = 2.94; SD = 0.78). The course difficulty variable was based on failure rates in the current courses. It was created by calculating the proportion of students achieving a D grade or lower across all sections of each course (e.g., if 80% of students who took the course received a D or lower grades, the difficulty would be 0.8). Course difficulty was then standardized (i.e., standardized difficulty = (raw difficulty – mean difficulty of all courses) / SD of all courses) around the mean failure rate of 0.28 (SD = 0.8; Range, 0.08 to 0.43) to render a continuous variable with mean of 0 and SD of 1. Hence, the larger the difficulty score, the more difficult the course was, and positive course difficulty scores (i.e., above mean) meant that the course was more difficult than the courses with negative difficulty scores (i.e., below mean).

The purpose of standardizing the two continuous variables (prior GPA and course difficulty) was for interpretability of results. Standardizing the two continuous variables created an interpretable zero-point. The remaining three variables OER use, Pell eligibility, and Male were binary and coded with an interpretable zero. Standardizing the two continuous independent variables made interpretation more consistent with the interpretation of binary variables, that is, the estimated change in the outcome variable if the independent variable (either standardized-continuous or binary) increases by a rational one unit. In addition, standardizing the continuous variable made the interaction effect more interpretable.

Results

Table 1 below show the results of regressing course grade (i.e., dependent variable) on OER, standardized previous GPA, standardized course difficulty, gender, Pell-eligibility, and the interaction between OER and standardized course difficulty (i.e., independent variables and the interaction term). The multiple R equals 0.446 with a coefficient of determination (R^2) of 0.199, which indicates 19.9% of the overall variance in the outcome, course grade, can be explained by the list of independent variables included in this study. The overall model is significant [$F(6,15,626) = 646.163, p < 0.0001$]. The zero-order correlation of OER with course grade was 0.025 which was significant ($p < 0.05$). However, in the presence of

all the other predictors, OER was not a significant predictor of course grade ($B = 0.025$, $\beta = 0.005$, $p = 0.469$). All other predictors in the model were significant. Previous GPA is the strongest predictor ($B = 0.605$, $\beta = 0.410$, $p < 0.001$) and accounts for 16.6 percent of the variance in course grade [semi-partial coefficient (0.408) squared = 0.166]. The unstandardized coefficient of 0.605 means that there was a projected 0.605-point increase (in a 5-point grade scale) in student course grades with every unit (i.e., 1 SD) increase in student previous GPA, holding other predictors constant. Importantly, the covariate of standardized course difficulty was significant in the presence of the other variables ($B = -0.349$, $\beta = -0.169$, $p < 0.001$); that is a predicted decrease of 0.349 point in student course grades with every unit (i.e., 1 SD) increase in course difficulty while holding other predictors constant. This pattern is also consistent with the zero-order correlation between course difficulty and course grade ($r = -0.159$). Reasonably, the coefficient was negative, meaning that course grades tended to be lower as course difficulty increased. Standardized course difficulty was based on the aggregated failure rate of each course which was based on student course grades. However, because the standardized course difficulty was aggregated across multiple sections for each course and the student course grade was based on individual performance, the zero-order correlation between them was not problematic with only one percent shared variance ($r = -0.138$, $r^2 = 0.019$). This strategy to estimate course difficulty is recommended as there do not appear to be issues with multicollinearity but does require a large sample of sections and courses.

Most importantly, the interaction between OER and standardized course difficulty was significant ($B = 0.248$, $\beta = 0.039$, $p < 0.001$). The positive valence of the interaction term indicates that although the general trend (main effect) is for course grade to decrease with increased standardized course difficulty, the presence of OER blunts the impact of standardized course difficulty on course grades.

Table 1

Regression of Course Grade on OER, GPA, Course Difficulty, Gender, Pell and Interaction between OER and Course Difficulty

Table 1. Regression of Course Grade on OER, GPA, Course Difficulty, Gender, Pell and Interaction between OER and Course Difficulty

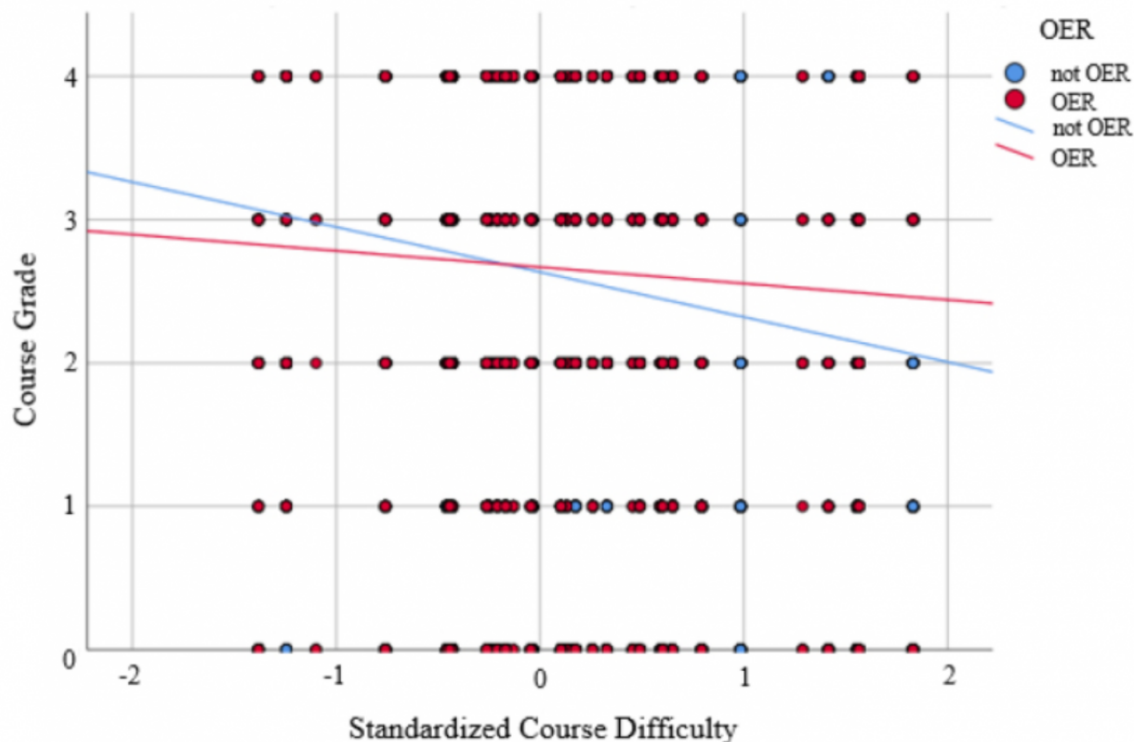
Variable	B	β	<i>t</i>	<i>p</i>	Zero-order	Tolerance
Constant	2.713		150.104			
OER course	0.025	0.005	0.724	$p = 0.469$	0.025	0.926
Previous GPA	0.605	0.410	57.009	$p < 0.001$	0.412	0.992
Course Difficulty	-0.349	-0.169	-22.354	$p < 0.001$	-0.159	0.894
Male	-0.054	-0.019	-2.555	$p = 0.011$	-0.065	0.965
Pell Eligibility	-0.151	-0.053	-7.280	$p < 0.001$	-0.040	0.982
OER X DIFF	0.248	0.039	4.943	$p < 0.001$	-0.012	0.842

Figure 1 below illustrates the significantly different slopes of the OER sections versus the non-OER sections using standardized course difficulty to predict course grades. The plot in Figure 1 is at zero-order for simple visualization purposes. However, it is very similar to and does not distort the image based on the plot of the predicted values that accounts for all the covariates in the model. As seen in Figure 1, the negative slope of the OER course is less severe than the negative slope of the non-OER courses.

Figure 1

Zero Order Plot of Interaction Between OER and Course Difficulty

Figure 1. Zero Order Plot of Interaction Between OER and Course Difficulty



The purpose of this study was to examine potential interactions between course difficulty and OER adoption on student grades. In addressing this purpose, we controlled for several potential confounds as recommended in Clinton and Kahn's (2019) meta-analysis while examining 15,633 course grades across 35 different college courses. Specifically, we controlled for self-reported gender, Pell eligibility, and importantly, previous academic performance. There was indeed an interaction between OER use and course difficulty on student grades in that OER adoption appeared to lessen the negative relationship between course difficulty and final grades.

To address this study's purpose, we calculated the unique measure of course difficulty based on the proportion of students who earned a D or F in each course. Because the study included multiple sections of many courses over multiple semesters, the calculation of current failure rate is arguably logical and stable. While course difficulty was ultimately dependent on individuals' course grades, the aggregation of failure rate across many sections and semesters did not result in undue multicollinearity, likely because of the large sample size involved.

The most important novel finding in this study, however, is the significant interaction between course difficulty and OER. The interaction term emerged in the presence of controlling for several potential confounds which typically "consume" available variance in multiple regression models predicting course grades. Finally, the interaction term emerged in the presence of a most powerful predictor, past student achievement. One potential explanation for this is that students'

need for course materials to perform well in a course may increase with course difficulty. In other words, it is possible that students are able to manage in less difficult courses without access to course materials, but for the more difficult courses they need support beyond what is provided by attending class and other freely available resources. This explanation is not something we are able to specifically test in our dataset but is supported by previous research findings in which students reported that not being able to afford course materials had negative academic consequences (Florida Virtual Campus, 2018). The access hypothesis applies here in that the students in difficult courses who may have needed course materials, but perhaps could not afford commercial materials, benefited from access to OER (Grimaldi et al., 2019). Moreover, the findings from this study indicate that one particular context—course difficulty—may potentially explain the variability in study findings in Clinton and Kahn's (2019) meta-analysis.

Finding that OER blunts the expected negative main effect of course difficulty on course grades is very hopeful. Whatever conditions exist in courses (instructor rigor, workload, speed of instruction, concreteness or abstractness of content, match between student interest/aptitude and content, instructor experience and effectiveness, or any other predictors) were subsumed parsimoniously, empirically, and quantitatively in the aggregated course failure rate. No causal claims are made, but prediction is powerful enough to justify gambling that OER used in historically difficult (higher failure rate) courses might blunt the negative trend. Certainly, the trend was not reversed. Difficult courses still tend to result in generally lower grades, but the presence of OER might make that phenomenon less so with zero cost to students.

The difficult courses are by definition are more challenging for students. In addition to OER use, other pedagogical interventions may be considered in future investigations in order to promote student learning in difficult courses, such as collaborative learning, providing more formative feedback to students, or promoting student motivations in the course.

While the zero-order correlation between OER and course grade was positive and significant (due to the large sample size), its beta-weight in the overall model was not significant. Controlling for gender, Pell eligibility, previous academic success and course difficulty diminished the weak positive association between OER and student outcomes. Even so, the zero-order result, as weak as it was, and the null result in the overall regression model still support the use of OER. This is not necessarily because of improved student achievement but on the grounds that student achievement using OER is on par with student achievement using traditional textbooks with zero costs to students. This null finding is the most frequently reported outcome (see Hilton 2016, 2019). OER produces similar results at diminished financial costs to our most financially vulnerable students.

Conclusion

Previous research findings have shown that OER provide students with similar learning outcomes as commercial materials at a greatly reduced cost (Clinton & Kahn, 2019; Hilton 2016, 2019). However, the efficacy of OER based on allowing students access to materials likely varies by context such as course, institution, and student characteristics (Grimaldi et al., 2019). In this study, we examined the potential context of course difficulty and found an interaction with OER use on course grades. Grades declined less with course difficulty when OER were used compared to when OER were not used. These findings are useful for instructors and institutions who may be considering OER adoption or methods of improving student grades in difficult courses.

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Recognizing and Overcoming Obstacles of OER

What It Will Take to Realize the Potential of OER

Julie Irvine, Royce Kimmons, & Jacob Rogers

Open Educational Resources

OER

Higher Education

Barriers

Despite the benefits of open educational resources, their adoption in higher education is hampered by real but solvable barriers.

Open educational resources (OER) are free, openly licensed materials that users can retain, reuse, revise, remix, and redistribute at any time. OER provide educators and students with significant, lasting benefits that far exceed what copyright-restricted materials can offer. Students who use OER save substantial amounts of money per term, savings that equate to greater financial security, and students can use the money they would have spent on expensive course materials to pay for food, health insurance, or tuition. Freeing up these funds helps eliminate some economic and access barriers, particularly for first-generation students, and can make community college attendance far less expensive. In a 2018 study, approximately half of surveyed two-year college students faced housing and food insecurity.¹ At many community colleges, "the cost of books per year exceeds the cost of tuition."² This means that steadily increasing textbook costs are unconscionable because they can prevent students from enrolling and completing their degrees while also making it difficult to provide for basic needs. In contrast, utilizing OER in more courses can alleviate some of the financial burden students face, decreasing the odds that they will withdraw from a course or not finish their degree.³

In addition to saving thousands of dollars on course materials by using OER, students can also experience greater freedom in their learning. OER allow students to access essential information on the first day of a course—without waiting for financial aid or books to arrive—and throughout their lifetimes. This unfettered access can increase performance in coursework and also promote lifelong learning and engagement in education.⁴ Additionally, because

these materials allow for continuous improvement and adaptability to students' needs, students can receive a more targeted, differentiated, and richer learning experience in courses where instructors use OER.⁵

Just as students benefit from the versatility OER provide, educators benefit from creating and utilizing these resources in their courses. One significant advantage for instructors is the ability to remix and edit content as needed to localize and adapt materials to individual and group needs, thereby promoting equity and differentiation for individuals and underserved learners. Instructors can also increase the impact and reach of their authored resources by releasing them openly, making content available to anyone, anywhere, at any time, thereby capitalizing on an open access bump.⁶ Furthermore, reducing barriers to publication and dissemination of materials can also empower the voices of traditionally marginalized educators, such as adjuncts, women, and BIPOC faculty, encouraging more democratized and open scholarship.⁷

Most educators believe that OER present benefits unmatched by traditional copyrighted resources, yet most faculty still don't use them and do not have any plans to use them in the future.⁸ Why this disparity? Failure to shift to OER cannot be interpreted simply through a lens of faculty deficiency—such as laziness, lack of interest, or greed—because faculty generally want to shift to OER. Rather, they are met by systemic and institutional barriers—including perceived lack of OER quality, issues surrounding accessibility and usability, and perceived lack of time—which prevent progress.⁹ For OER to proliferate, institutions need to address barriers that short-circuit positive motivations among faculty, giving them space to make these valuable shifts.

Perceptions of Quality

Faculty and students alike often view open textbooks as being poor in quality.¹⁰ Although this perception isn't entirely unfounded, it is resolvable. Traditional publishing models that rely on multiple rounds of editing and review by specialized personnel—such as graphic designers and editors—set a narrow standard for how faculty perceive quality, a standard that may be much more based on factors such as aesthetics and grammar than on learning design, content accuracy, or usefulness to students.¹¹ This means that without hiring specialized personnel for help, even someone who is an expert in a field generally can't publish an open textbook that, on its surface, will look as good as a commercial alternative.

To solve this issue, colleges and universities can provide faculty with editors and graphic designers who can be involved in the publication of open materials. Additionally, the tools used for creating OER should be designed to make quality a top priority. Whether institutions choose to hire students as editors and graphic designers, use freelance professionals, or provide publishing support in another form, faculty will benefit from the combined institutional support and the skills of others during the authoring process. This will make resulting OER more amenable to adoption. Furthermore, online platforms that host OER (e.g., EdTech Books, Equity Press, PressBooks, OpenStax, CK-12) can provide user guides that walk authors through the publication process and offer simple tools to enhance the finished work, such as automated accessibility and grammar checks. Those guides and the addition of editors and designers can mitigate the barriers of perceived quality, lack of skill, lack of institutional support, and even lack of time that some faculty face. Just as learning produces the best results when it is done collaboratively, OER are best produced with the help of diverse experts using tools specifically designed for the purpose of creating quality content.

OER can afford the opportunity to redefine the quality of textbooks (and other resources) by refocusing our perceptions of quality on how beneficial resources are for learners. When we as educators and leaders remove process-oriented parameters surrounding our understanding of what makes quality course material (e.g., peer review) and instead focus on the produced materials themselves, we open doors for OER to help us rethink the possibilities of what we can expect from our resources.

One way we can redefine our understanding of quality is by looking at student involvement with learning materials. Currently, curricula and course materials are predetermined by higher education institutions and faculty. Students receive book lists at the start of every term, purchase hundreds of dollars' worth of material they will likely only use

during that semester, and then face the challenge of trying to sell those materials at a fraction of their cost or else have sixty-dollar paperweights on their shelves. Nowhere in this process are students actively engaging with their learning, nor are they involved in creating course content that will facilitate lifelong learning for themselves and their peers.

In contrast, what if students were involved in the creation, improvement, or evaluation of their own textbooks? Christina Hendricks provides examples of students who have contributed invaluable research, writing, and revision to existing OER, fostering continuous improvement for curricula at many institutions.¹² Scott Woodward, Adam Lloyd, and Royce Kimmons articulated a path for how students' vetting of textbooks could itself be a valuable curricular activity.¹³ In addition, many faculty have experimented with approaches to having students develop OER as primary course learning activities.¹⁴ Combining OER with student-led learning can also eliminate disposable assignments—assignments that "add no value to the world" and are therefore unmotivating.¹⁵ When students provide input or direct their own learning in these ways, OER and coursework can be more effective by overcoming motivational and authenticity barriers to student learning.

Similarly, OER allow textbook quality to be redefined through the lens of continuous improvement.¹⁶ This lens ensures that the goal of producing textbooks is not just to publish a text but also to regularly review the content and update it according to students' needs and a changing world. Updating OER content may take into account new research findings or increased awareness of social, ethical, and cultural considerations. Continuous improvement also allows for remixability of text content at any time, which encourages dynamic learning experiences. Tools such as collaborative authorship, embedded learning checks in the text, and PDF availability provide opportunities for students and faculty to interact with OER in meaningful ways that will help improve the quality of the texts over time, and collaborative authorship can specifically ameliorate the lack of time and support some faculty face when trying to publish or improve existing resources.

Accessibility and Usability

Another barrier to the widespread use of OER is the lack of technological tools for sharing and adapting resources, which results in poor accessibility and usability of the OER. Because our goal as content creators, instructors, and faculty should be to provide quality learning opportunities to as many individuals as possible, we must consider the needs of our audience. Even though the content of a textbook may be well written, edited, and produced, it does no good if the book itself is inaccessible or unusable to parts of its intended audience. This discrepancy between consumable content and accessibility was shown in a study of K–12 websites across the United States. The study found that "95.5 percent of school home pages had a detectable [accessibility] error of some kind, with the average site having over 24 errors."¹⁷ That study also found that most errors were at the system level rather than the content level, and similar results have been found for college and university websites.¹⁸ Examples of potential accessibility issues that occur at the system level include the following:

- Lack of alternative text for images
- Inappropriate font sizes
- Lack of sufficient contrast between the text and background
- Incorrect order of the text (especially heading levels and layout of the information)
- Lack of compatibility with mobile devices
- Incorrect use of tables within the text
- Lack of transcripts available for videos

Such findings can be applied to OER in the sense that content creators need to work in lockstep with software developers who are familiar with these technologies to solve system-level accessibility and usability issues before OER are published on a website. Many of the accessibility and usability issues that exist in OER can be remedied with careful attention to system-level design by developers creating tools to seamlessly address them at the software (rather than content) level. Many OER publishing platforms such as EdTech Books are increasingly employing mobile-first design strategies, appropriate heading structures, high contrasts, sufficient font sizes, options for multiple formats (e.g., HTML,

PDF), search features, and various other design decisions promoting usability and accessibility that carry over to highly usable content. Each of these solutions is an example of how institutions can support educators by correcting common problems both before and after texts are published, and such attention to system-level solutions creates more accessible and higher-quality OER that can benefit students with various needs.

Usability can also be addressed at the content level by adapting content to appropriate reading levels. As content authors focus on the needs of their audience, they must consider their backgrounds. Some students may be learning English as a second language and require content that is more compatible to their reading level. Other students may be first-generation college students or come from homes where academic language is not commonly used. Each of these students will benefit from course materials that use language better targeted to their individual cases. One solution to this barrier that some platforms now provide is utilizing Flesch-Kincaid or other reading scores to continually evaluate the language used in OER and use this to signal to authors when content needs to be simplified. This solution transforms technology from a barrier into a support for educators who are publishing open content. For example, if an instructor primarily writes at a 12th-grade reading level, that instructor can use automated reading scores to reevaluate and adjust the writing style to be more appropriate for students at all levels, much as prominent publications such as *The New York Times* and *The Wall Street Journal* do with their content. When this barrier is solved, educators enhance students' learning flow and ability to interact with course content, and attention to all of these considerations reduces the time students would otherwise spend trying to troubleshoot technological or content problems.

Perceived Time Commitment

Finally, perhaps the greatest barrier to OER creation and adoption among higher education faculty stems from a perceived lack of time to devote to these activities, which is generally interpreted through a lens of the compatibility of these activities with the work expectations necessary for tenure, promotion, grant seeking, or simply keeping one's job. Interpreting OER efforts through the three-pronged lens of faculty work requirements—research, teaching, and citizenship—may uncover some obvious overlaps, such as between improving course content and teaching, but the major barrier seems to be that faculty and their evaluators do not consider OER work to be scholarly in nature. After all, who would spend time writing an open textbook when one's job security is almost wholly dependent upon publishing scientific articles or securing grants? This is perhaps the most difficult problem to solve in the diffusion of OER in higher education, but some solutions may be found by encouraging a rethinking of what we mean by scholarship and scholarly impact.

At the heart of scholarship is the notion of impact. Scientific journals and other professional outlets are typically ranked in terms of particular impact metrics, like impact factor or h-index, and scholars use these rankings as proxies for determining the reach that their work is having on their scientific communities and on society more broadly. However, just as OER may empower us to rethink what we mean by "quality," they may also empower us to rethink what we mean by "impact." In our case, Royce Kimmons has published broadly in scientific journals and highly regarded edited volumes but has also provided similar content as open textbook chapters. As an example, one of his chapters on copyright considerations for teachers that was published traditionally in an edited volume has been downloaded 1,300 times, while his open textbook chapter with similar content has been accessed or downloaded 10-times more frequently.¹⁹ Which of these venues is having the greater impact on the intended professional community and society broadly? Though expectations of tenure committees will not change instantly, OER may provide opportunities to reconsider the potential reach and impacts that scholars should be having on the world and their professional communities, and OER platforms can support this by providing detailed analytics and impact measurements to authors. In the case above, the open chapter hosted by EdTech Books gathers detailed evidence about impact, including page views, downloads, reads, backlinks, reading likelihood, and even predicted cost savings to readers. With such metrics in hand, faculty may find themselves in a better position to justify the time they spend with OER and thereby influence institutions to take a broader view of scholarly impact beyond a single, esoteric metric.

Closing the Gap to OER Adoption

Students and faculty agree that OER are clearly beneficial in education. However, due to some clear barriers, OER are largely untapped resources at many colleges and universities, and OER creation may be viewed as incompatible with how faculty members' job performance is evaluated. Lack of support, technological tools, quality, skill, and time prevents many educators from publishing or using OER, but with a little rethinking and innovation in the tools we use and the processes we follow, those barriers can be reduced or altogether eliminated. Doing so will provide benefits to students, by driving down costs and improving learning materials, and also to faculty, by improving teaching and scholarly impact. Rethinking our practices and tools in these ways can increase students' educational opportunities and quality of learning and allow faculty scholars to amplify their voices and increase their impact, both in their fields and in the world at large.

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Sharing and Self-promoting

An Analysis of Educator Tweeting at the Onset of the COVID-19 Pandemic

Jeffrey P. Carpenter, Torrey Trust, Royce Kimmons, & Daniel G. Krutka

Social Media

Teacher Professional Development

Informal Learning

Adult learning

Researchers have documented an array of ways Twitter hashtags offer digital spaces where educators can connect around interests and needs. During the early days of the COVID-19 pandemic, educators tweeted using various pandemic-related Twitter hashtags. In this study, we analyze data from two such hashtags: #remoteteaching and #remotelearning. We first data mined more than 36,000 tweets and then analyzed a random sample of 1,148 tweets and the accounts which sent those tweets. Our results suggest that the hashtags functioned as spaces in which a variety of education stakeholders engaged in activities that included knowledge sharing, social sharing, and information broadcasting. Alongside and sometimes entangled with such sharing, there was also a great deal of self-promotion. We discuss how these spaces appeared to offer potential benefits to educators navigating the transition to remote teaching but also consider how the presence of self-promotion may suggest downsides to such social mediums. We conclude with implications of these findings for education stakeholders and future research.

1. Introduction

The COVID-19 pandemic disrupted educators' lives in many ways. Teachers faced challenges related to shifts in their teaching, societal inequities intensified by the pandemic, and managing their own professional loss and stress [59]. The rapid change from in-person to emergency remote teaching [88] increased the need for targeted and timely professional development (PD) for educators [29]. However, teachers faced the abrupt transition to remote learning often without

their typical access to many forms of formal PD, such as in-person courses, instructional coaching, or professional conferences. Many teachers found themselves in the proverbial deep end of the pool and some turned to social media for just-in-time professional activities to stay afloat.

In this paper, we build upon preliminary research on tweets posted by teachers to two hashtags: #remoteteaching and #remoteteaching [93]. Herein, we expand and deepen our analysis to include a larger dataset and all types of users (e.g., organizations, for-profit businesses, parents) who tweeted with these hashtags. The purpose of this study is to investigate the dynamics of these hashtags, including who participated, the structure of tweets posted, and the content of tweets. We address the following overarching research question: what was the nature of the #remoteteaching and #remoteteaching spaces in the early days of the COVID-19 pandemic? We seek to offer insights for educators and education stakeholders regarding the opportunities and challenges for just-in-time professional activities associated with social media platforms [24,27]. Furthermore, we consider the affordances and constraints of social media during a time of change and crisis.

2. Background

Researchers have identified multiple potential benefits to educators' use of various social media platforms, including Facebook [77], Instagram [95], Pinterest [66], Reddit [96], and Twitter [107,28]. Social media can be used to find, share, and discuss education ideas and resources, with educators functioning as both knowledge givers and receivers [77]. Since social media is not geographically or temporally bound, professional learning via social media can potentially happen at almost any time of day and from any location ([66,92]). Thanks to the access it provides to individuals beyond their own schools, many teachers use social media to build networks, sustain relationships, and receive emotional support [24]. Social media use can also serendipitously expose educators to ideas and perspectives that they otherwise might not encounter in their local schools or districts [35]. Although PD has often been framed as content delivery, social media use for PD can also involve content generation and curation, with teachers themselves creating some content through independent and collaborative work [54].

Alongside the potential benefits of educators' social media use, there are also associated barriers, complications, obstacles, and risks [38,89,97]. While social media might offer increased access to content, face-to-face professional learning opportunities may be better suited to developing trusting relationships among educators and can be more deeply rooted in school communities. Additionally, the quantity of content on social media can be both beneficial and overwhelming. Wading through the glut of information available, educators may struggle to find the resources they need and could come to find their social media usage a waste of their limited time for professional learning [71,98]. Spam can clutter the traffic on some popular education-focused Twitter hashtags [99]. The lack of traditional content vetting and regulation on social media also raises quality concerns. For example, Sawyer and colleagues' [65] research reported that popular elementary mathematics teaching resources posted on Pinterest involved only lower-level cognitive demands, and Rodriguez, Brown, and Vickery's [61] analysis detailed how teacher candidates used online resources with problematic historical narratives about the U.S. Civil Rights Movement.

Educators who employ social media can also experience identity-related challenges. They may feel pressured to present themselves in idealized forms [60]. Teachers can struggle to manage boundaries between personal and professional worlds and feel obligated to be always available to communicate with colleagues, students, and families [19,67]. The common highlight-reel quality of self-presentation on social media raises questions around authenticity and can contribute to unhealthy social comparisons [84,95] and unrealistic expectations regarding what is a "good enough teacher" ([52], p. 30). Although teachers can make their practice public via social media, what they are willing to share may be constrained. For example, they may self-censor their posts for fear of other people's reactions [94,97,98]. Teachers may be more willing to discuss thorny subjects or try innovative practices in more private contexts [42]. Each communication medium shapes the kinds of messages users share [44], and different social media services present different affordances and constraints for educator professional learning. While Twitter's open nature can invite broad participation, it may also limit the content users share and how they discuss it. Twitter's limited character count may make it easy for quick interactions, but it can also reward users for more outrageous and overly simplified claims that

generate likes and retweets. Although social media spaces for teachers are often relatively collegial, toxic subcultures, racism, networked misogyny, and other forms of cyberviolence have been all-too-common features of social media, and both explicit and implicit forms of discrimination can impact educators' experiences of educational spaces on Twitter [33,47,109].

2.1. Educator Twitter affinity spaces

Scholars have sought to understand social media, including Twitter, as *spaces* in which educators participate in professional activities [41,45]. In the case of open, for-profit social media such as Twitter, we prefer conceptualizing the phenomenon through the concept of space rather than with concepts of *community*, such as Community of Practice [39] and Community of Interest [31]. We agree with Gee [25] that discriminating among who should be included as a community member and who should be excluded can be both challenging and distracting. Furthermore, the ad hoc and potentially ephemeral nature of the hashtags we studied rendered a community lens inappropriate [6].

We therefore draw on Gee's [25] affinity space concept in this study. Gee defined affinity spaces as digital, physical, or blended locations in which informal learning occurs and common limitations associated with time, hierarchy, and geography are mitigated. Individuals are attracted to affinity spaces by a shared interest or endeavor. Although digital technologies are not a prerequisite for affinity spaces to exist, these technologies arguably can facilitate the creation and expansion of such spaces. Scholars of education and social media have used the affinity space concept to explain or frame analyses of Twitter hashtags in previous studies (e.g., [62,100]). This lens has proven appropriate to studying the unbounded and fluid nature of participation common with Twitter hashtags. Moreover, researchers have recently demonstrated that different hashtags can host distinct kinds of affinity spaces for educators' professional Twitter uses [26,28,101].

2.1.1. Who participates in educator Twitter affinity spaces

The open nature of Twitter means that anyone, within or outside of education, can participate in finding, sharing, and discussing information on the platform. For example, teachers, instructional support staff, and principals from various schools and districts can all contribute to and learn from Twitter conversations (e.g., [8,12,63]). Twitter also allows teachers to make their learning and practice public in ways that can benefit them and others [36,40], such as parents who had to support their children's learning from home due to the COVID-19 pandemic [46] and might have looked to educators' tweets for, information, advice, and support (see [15]). Wang [85,86] demonstrated that many education authorities in public-facing roles, such as superintendents and state education agency staff, have used Twitter to share information with communities and constituents.

Participation in affinity spaces is frequently motivated by shared interest in a topic and intrinsic enjoyment of the interactions. Education stakeholders from various roles can potentially participate in sharing and discussions that include a range of educational experiences and expertise. For example, Rosenberg and colleagues [63] studied #NGSSchat, a hashtag associated with the Next Generation Science Standards, and found that in addition to teachers, various education researchers, education organizations, education institutions, and media accounts also contributed to the hashtag traffic.

Although some parties engage with affinity spaces because they share interest in a common endeavor with other users, others may participate even if their motivations related to that endeavor may not solely lie in engaging around the topic. For instance, some educators may use affinity spaces for self-promotion and online *teacherpreneurship* (i.e., the sale of education resources by educators through online educational marketplaces) rather than from a desire for professional learning [69,71,98]. Teachers and teacherpreneurs alike may both seek to produce, share, and find curriculum and teaching ideas, but with different end goals in mind. Teacherpreneurs, education influencers, and even traditional curriculum publishing houses tend to use social media to market their wares in both direct and in-direct ways [69], [70], [71],102] that some users may find distracting [98]. Education institutions and organizations, businesses or individuals, and parents can also all potentially post to Twitter hashtags and may bring commercial or other motivations to such spaces.

While various stakeholders can interact with teachers through Twitter, there is limited research looking holistically at who engages in educator Twitter affinity spaces in times of crises. Previous studies generally focus on Twitter engagement by specific groups of people (e.g., teachers, principals, superintendents, or parents). For example, Rehm and colleagues [57] have recently published an analysis of school leaders' uses of Twitter during the COVID-19 era. Although such research offers valuable contributions to the field, understanding who the many actors are using education hashtag spaces can help scholars and education stakeholders uncover the multifaceted network of influencers within a single affinity space. Furthermore, there is only limited knowledge of how the various communication means and ends of such different actors might clash and commingle in educator hashtag spaces. This study therefore advances the knowledge base by investigating the full range of users who used two popular education-related hashtags.

2.1.2. How users participate in educator Twitter affinity spaces

Content on Twitter can be structured in various ways. Twitter users can post their own content in *original tweets*, *reply* directly to other users' tweets, *retweet* other users' content by broadcasting it to their followers, and *comment tweet* by retweeting other users' content and adding their own thoughts. Original tweets generally consist of text, visuals (e.g., images, memes, gifs), videos, links, hashtags, or any combination of those. Users can point to content found elsewhere on the Internet by including hyperlinks to sites outside of Twitter [17], which allows for the referencing and sharing of ideas beyond those contained within the character count of single tweets (i.e., 280 characters). For instance, teachers might tweet to recommend a particular article and include a link to the article. Users can also embed information in images or videos to overcome the character limit, like when a teacher tweets an infographic filled with text or presents a video in which they talk through their experiences in depth. Images and videos may also be used in social media spaces to invite interaction and establish conviviality and friendliness among users [79] or to make teaching practice public in direct ways [40].

Twitter hashtags play an important part in educators' Twitter use [28,87,101], in a variety of contexts [27,58]. Although the relentless and massive quantity of content on Twitter has resulted in comparisons to "drinking from the firehose" ([9], p. 413), hashtags can, in some cases, help users to partition off relevant and more manageable streams of content. Hashtags can facilitate connections and collaborations among educators who share common interests and needs but might not otherwise meet or interact. For example, Wesely [108] studied how geographically distant World Language teachers used a Twitter hashtag to interact in ways that contributed "to sustained and significant teacher learning" (p. 305). Twitter hashtags can enable various forms of in-group communication among members of a profession, and also more outward facing communication, what Acquaviva [2] described respectively as *intercom* and *megaphone* hashtag uses. While various technologies support participation in micro- and meso-level communications, hashtags help tweets reach beyond users' existing follower-followee networks [7] and can therefore create more opportunities for educators to participate in macro-level conversations on education topics. However, popular educator hashtags can also become targets of spam [99] and feature large amounts of self-promotion [71], especially by men [33].

2.1.3. Why users participate in educator Twitter affinity spaces

Since its early days, Twitter has been identified as having potential educational applications, including for educator professional activity. Forte, Humphreys, and Park's [18] content analysis of education-related tweets described multiple forms of engagement on Twitter, including sharing information, providing advice, discussing policy, promoting events, self-promotion, asking or responding to questions, and sharing educational philosophies. Although early research on the use of Twitter in education was concentrated in higher education contexts (e.g., [32]), several more recent studies highlight Twitter's capacity to support PK-12 educators' work, including resource sharing and facilitating interactions among diverse stakeholders [27]. For instance, Carpenter and Krutka's [100] survey research indicated that many participants valued Twitter's capacity to reduce various kinds of isolation and that the medium facilitated personalized, positive, and collaborative professional learning.

Twitter can enable just-in-time professional learning by hosting flexible environments that allow teachers to interact with colleagues and experts who can help them with their current questions and provide "on-demand" and "real-time"

support ([103] p. 716). Such flexible spaces would appear to offer some value during the uncertainty and disruption caused by crises [27]. For example, while many conferences have been disrupted by the COVID-19 pandemic, social media tools have remained accessible throughout the pandemic and offered a source of ongoing opportunities for learning [93]. Because of features such as timeliness and personalization, Twitter would seem to have some potential to facilitate educator PD during crises. However, education stakeholders' Twitter use during crises has received only limited and preliminary attention [29], [93].

Although Twitter hashtags often develop in response to current events [6], in education research, prior studies have primarily focused on relatively established and quasi-permanent hashtag spaces [71,87,101] and those associated with specific content areas (e.g., [108]). For example, Parrish and Martin [51] investigated a long-running math-focused hashtag (#MTBoS) and reported that it provided teachers with opportunities to learn how to teach math in ambitious and cognitively demanding ways. An exception in which an ad hoc hashtag was studied can be found in Greenhalgh and Koehler's [27] exploration of how 3,598 Twitter users across multiple countries employed a hashtag to create a temporary space that supported French teachers preparing to discuss the 2015 Paris terrorist attacks with their students. We build on Greenhalgh and Koehler's work by investigating hashtag spaces that similarly have offered opportunities for educators to discuss how to respond to an unanticipated disruption to their work. The context of Greenhalgh and Koehler's study was, however, a particular tragic episode with a relatively less direct and less pervasive impact on teachers' work. By contrast, the COVID-19 pandemic has been a protracted crisis that has arguably upended the very nature of schooling and educators' lives in general.

2.2. Educator PD in times of crises

Although research on how educators respond to crises on the scale of COVID-19 pandemic is lacking, studies on educators' experiences with local disasters inform the present study. Researchers consistently find that teachers facing crises need new and varied kinds of professional support. In the aftermath of trauma, teachers require PD in order to manage their own stressors and those of their students [4,30]. In some scenarios, schools have to function as the de facto mental health support system for many children [11]. Ubit and Bartholomaeus' [76] research in the wake of the 2004 Indonesia tsunami detailed how teachers needed PD that helped them to work with young people affected by the natural disaster. During crises, teachers are often expected to focus on the needs of their pupils, rather than their own well-being [43]. In crisis scenarios, PD demand can be high, and traditional PD mechanisms can struggle to adapt to unpredictable contexts.

Teachers' professional needs and experiences are often quite idiosyncratic, and this is likely the case during crises [49,50]. For example, while synchronous PD events may work for teachers without young children, teachers who are trying to care for young children in their own homes may prefer asynchronous opportunities. Social media could provide some of the flexibility and personalization that would benefit educator PD in crisis contexts. Research that addresses the opportunities and barriers associated with social media use for PD during crises can therefore benefit the field.

To address these gaps in the literature and explore the professional learning opportunities available via Twitter, our research question was the following: What was the nature of the #remoteteaching and #remotelearning spaces in the early days of the COVID-19 pandemic? We divided this larger question into subquestions:

- RQ1. What types of accounts tweeted in these spaces?
- RQ2. What was the structure of the tweets?
- RQ3. What appeared to be the purposes of the tweets?

3. Method

In this descriptive mixed-methods study, we analyzed tweets from two hashtags that attracted substantial traffic during the onset of the COVID-19 pandemic: #remoteteaching and #remotelearning. These two hashtags were used as common hashtags in the U.S. between late February and April 2020 and attracted more usage than other hashtags dealing with teaching during the pandemic (e.g., #triageteaching, #pandemicteaching) during that time. These ad hoc

spaces increased in popularity in response to the COVID-19 pandemic and were thus distinct from some related hashtags like #onlinelearning and #onlineteaching that were in use prior to the COVID-19 pandemic and may have had previously established norms and practices.

3.1. Data collection

We collected tweets from early-March to mid-April using the Twitter Search API. Excluding retweets, our search returned 36,788 tweets from 14,895 accounts for analysis. We excluded content that the Twitter Search API identified as retweets. We did this because although retweets increase the potential reach of tweets by sharing them with a larger audience, they do not directly add new content to a hashtag space. Retweets were not, therefore, germane to our research questions.

In our earlier work [93], we focused on users who defined themselves as PK-12 teachers in their profile. However, in this study, because of our broader research question, we did not narrow our focus in the same way. For our manual analysis, we selected a representative sample of tweets by utilizing the random ordering function in a MySQL query and returning the first 1,200 results. For these 1,200 tweets, we later downloaded information about the number of retweets and likes that each received. At the time of data analysis, 52 of the tweets had been deleted or were no longer available, resulting in a final data subset of 1,148 tweets that were sent from 960 unique Twitter accounts.

3.2. Data analysis

We analyzed the sample of 1,148 tweets in ways that aligned with our research questions. To bolster trustworthiness and credibility [75], we employed investigator triangulation by having at least two researchers involved in all qualitative data analysis [16]. In our earlier analysis of a smaller sample of tweets from the same two hashtags [93], we inductively identified codes through an iterative process, informed by the literature on educator PD via Twitter. This process resulted in a set of 12 codes that were primarily oriented towards categorizing the content of the tweets (Appendix Table A1, *Initial Codes for Tweet Content and Twitter Account Roles*). In this study, we began coding the new sample of tweets informed by this earlier codebook, although we maintained an openness to change existing codes and add new codes. Initially, two coders separately read 100 tweets each before meeting to compare their first impressions of whether the prior codebook was appropriate. Given the wide variety of education stakeholders that were tweeting using the hashtags, we also coded the roles of the Twitter accounts sending each tweet as well as the content of the tweets. An initial set of nine roles associated with accounts was identified based on the first batch of tweets read (Appendix Table A1).

Three of the researchers engaged in three cycles of independently coding subsets of 50-100 tweets and then meeting to discuss our coding, resolve discrepancies of interpretation, and refine the codebook. During one of these meetings, the three researchers also collaboratively coded a set of tweets together in order to build consistency in our interpretations of the codes. The fourth member of the research team, while not directly involved in coding, participated in some of the discussions regarding the codes and their meanings. Due to the interpretive nature of our coding process, we relied upon intensive discussion to reconcile discrepancies and reach consensus on codes, instead of an interrater reliability statistic [64]. After these three rounds of coding and discussion, we achieved substantial agreement regarding our understanding and application of the codes, and settled on our codebooks (see Appendix Table A2,A3,A4). The final codebooks included 11 codes for role types, and an additional three non-exclusive subcodes that could be applied to individual educator roles (Appendix Table A2, *Final Codebook for Twitter Account Roles*). There were 22 codes that related to the content of tweets, nine of which were codes drawn from the aforementioned initial 12 codes used in Trust et al. ([93]; Appendix Table A1). Seven of the 22 codes referred to more basic information about the tweet structure that could be relatively objectively coded, such as if the tweet was a comment tweet or included a hyperlink (Appendix Table A3, *Final Codebook for Tweet Structure*). The remaining 15 of the 22 codes for tweet content pertained to purposes; we grouped these into four categories (Appendix Table A4, *Final Codebook for Tweet Content*). As an example of how the code structure developed, a broad initial code related to *discussion* was narrowed to focus on discussion that occurred in synchronous Twitter chats, given that other markers of discussion (such as a tweet being a *reply* tweet) were reflected in other codes. With the codebook finalized,

two of the researchers recoded tweets that had been coded with earlier versions of the codebook and completed the coding of the remaining uncoded tweets.

In addition to coding tweet content, we also looked at the user profiles for the accounts that posted each of the tweets. In some instances, the profile provided sufficient information to identify the role associated with the account. However, we sometimes needed to do additional exploring to determine users' roles. For example, many Twitter profiles included a hyperlink to a website, such as a LinkedIn page, where we found the necessary information. In some instances, we used an Internet search engine and available information in the Twitter profile in order to determine users' roles.

Finally, we used the statistical computing software R [55] to conduct multiple chi-square tests of independence, with Yates' continuity correction, in order to test whether certain kinds of tweets—in terms of the content and the type of account—were more or less likely to have been liked or retweeted. We did this in part because Twitter's algorithm pushes content that receives more likes or retweets. This impacts the kinds of tweets people see and, for some users, impact the ways they post (e.g., posting images to garner more impressions).

4. Results

Our analysis of the dataset demonstrates that #remoteteaching and #remotelearning were multifaceted spaces that featured a wide variety of content posted from accounts that represented a diverse range of education stakeholders and motivations. In the following sections, we will detail our findings in relation to each research question.

4.1. RQ1. What types of accounts tweeted in these spaces?

In total, 960 unique accounts posted the 1148 tweets in our sample. Almost half of the tweets ($n=549$; 48%) were sent from accounts belonging to individuals working in PK-12 schools, including tweets from PK-12 classroom educators ($n=365$; 32%), school and district support professionals ($n=122$; 10%), and administrators ($n=62$, 5%). Additionally, 5% ($n=60$) of the tweets came from accounts belonging to higher education professionals, including faculty from a range of disciplines (e.g., civil engineering, teacher education, history), faculty development specialists, and university administrators.

In addition to the primary job roles of the PK-Higher Education accounts, some individuals also were identified in three particular ways: Edtech Tool Ambassador, Certified Educator, or Edupreneur (Table 1). For example, one profile read, "Math Teacher | Google Trainer | EdPuzzle Coach | Flipgrid, Genially, Wakelet, WeVideo & Seesaw Ambassador" - this educator was an ambassador for multiple tools and certified in a particular educational technology (i.e., Google Trainer). There were also practicing educators that focused on selling their own books, materials, TeachersPayTeachers resources, or services; we labeled these accounts as *edupreneurs*. For instance, text from one profile stated, "Co-Author of [Title Removed for Anonymity], Global Presenter, Keynote Speaker, #MIEExpert [Microsoft in Education] and Fellow." In our categorization, we distinguished such individuals who engaged in entrepreneurial activities while working as a PK-12 educator from accounts associated with for-profit education-related businesses, consultants, or individuals who were full-time employees of such businesses. It was slightly more common for school and district support professionals to be an educational technology tool ambassador, educational technology tool certified educator, or edupreneur when compared to teachers. It was also more common for support professionals and teachers to include these designations in their profiles than it was for administrators (see Table 1). As seen in these examples, some accounts received more than one of the three subcodes.

Table 1. Accounts with Edtech Tool Ambassador, Certified Educator, or Edupreneur Designations in Profile

Empty Cell	Total	Edtech Tool Ambassador		Edtech Certification		Edupreneur	
Role	n	n	% of total for role	n	% of total for role	n	% of total for role
Teacher	365	65	18	55	15	41	11
Other PK-12 School Role	124	24	20	22	18	23	19

Empty Cell	Total	Edtech Tool Ambassador		Edtech Certification		Edupreneur	
Administrator	61	3	5	2	3	5	8
Higher Education	60	3	5	5	8	2	3
Total	610	95	16	84	14	71	12

Approximately one-third of tweets ($n=378$) came from accounts associated with non-profit or for-profit individuals or organizations. Most of these tweets ($n=299$) came from accounts that represented for-profit individuals or organizations, while tweets from non-profit organizations (e.g., Advocates for Children of New York) or individuals who worked for non-profit organizations ($n=79$) were less common. For-profit organizations were mostly educational technology companies (e.g., EdPuzzle) or companies that provided educational services or curriculum materials (e.g., McGraw Hill PreK-12). Among the accounts with more than one tweet in our random sample, the education technology companies Buncee ($n=7$), ClassDojo ($n=9$), and Microsoft Education ($n=16$) contributed the most tweets. For-profit individuals were most commonly employees of educational technology companies or those who had prior experience in education and then shifted into consulting roles.

The sample also included accounts for schools, higher education students, and parents. School accounts contributed 9% of the tweets in the dataset. The majority of these tweets came from accounts associated with individual public schools or school districts ($n=71$; 6%), such as P.S. 215 Brooklyn and Lakota Local Schools. A smaller number of tweets came from accounts that belonged to private schools ($n=36$; 3%). Although many educators are also parents, some tweets ($n=46$, 4%) were sent by users who appeared to be posting solely from a parental perspective. Tweets from higher education students ($n=16$), many of whom studied education, made up 1% of the tweets in the dataset. In sum, the findings indicate that these hashtags were open public spaces utilized by a wide array of individuals and organizations.

4.2. RQ2. What was the structure of the tweets?

The majority of tweets in our sample were *original tweets* ($n=763$; 66%). The dataset also included two kinds of comment tweets as well as reply tweets. Many tweets also featured embedded hyperlinks and/or media. Nearly one-fifth ($n=220$; 19%) were retweets with added comments, also known as *comment tweets*. For example, one individual retweeted a post about assessment and included a comment: “Great perspective to consider as we move into remote learning environments! #assessment #remoteteaching.” We coded separately some of the *comment tweets* for which the comments were not substantive; we considered these to essentially function as retweets ($n=80$; 7%). Such posts seemed to be solely for the purpose of increasing viewership of an original tweet. For instance, an individual might retweet a relevant teaching resource and simply add hashtags like #remoteteaching or #remoteteaching.

Less than 10% ($n=92$) of the tweets in our random sample were replies sent using the “reply” function of the Twitter interface. Twenty of these replies (22%) were posted as part of Twitter chats, which feature synchronous posting on Twitter around specific questions (see [22]). The remaining tweets in this category were either a single reply or a thread of replies by a single individual. Twenty (22%) of the single reply tweets were posted by education technology companies, including 14 from Microsoft, two from Buncee, and two from WeVideo. For instance, in reply to an educator who wrote about setting up Microsoft Team meetings for remote learning, @MicrosoftEdu wrote, “We are excited to see how you and your students enjoy Microsoft Teams.”

Tweets—whether original posts, retweets, comment tweets, or replies—often featured embedded media directly uploaded by the user, including graphics, gifs, memes, photos, or videos. Slightly more than half ($n=641$; 56%) of the tweets included embedded media. Graphics were generally used for promoting events (e.g., event flyers) or sharing information visually (e.g., infographics), while gifs and memes tended to be used for humor or affect. Embedded photos ranged from images of student work and educators’ remote teaching spaces to stock photos that added visual appeal. Embedded videos, which are videos created by the users and uploaded directly to Twitter, were also popular. These ranged from humorous short segments (e.g., a teacher trying to sing along to the Broadway musical *Hamilton*), to information broadcasting, to technology tips and tricks.

Almost 40% of the posts ($n=472$) included hyperlinks to external websites. When tweeting a hyperlink, Twitter's algorithm will often display a visual from the external website or the hyperlinked video. However, only one-third of tweets featuring hyperlinks ($n=157$) included such an automatically inserted image or video. By contrast, 43% of the hyperlinked tweets ($n=205$) included embedded images or video purposefully uploaded by users. This may be because users wanted to display a visual different from the one Twitter selected from their external site (e.g., showcasing an event flyer) or because Twitter did not display a visual with the hyperlink.

4.3. RQ3. What appeared to be the purposes of the tweets?

Upon exploration of the tweet content, we identified four overlapping themes encompassing the purposes for posting on the #remoteteaching or #remotelearning hashtags: *professional knowledge sharing*, *social sharing*, *self-promotion*, and *information broadcasting* (see codebook Table A4 in Appendix). Individual tweets could include multiple purposes. For example, some tweets featured both professional knowledge sharing and self-promotion.

In approximately half of the tweets ($n=569$), users shared professional knowledge. Slightly more than one-third of these tweets ($n=196$; 34%) focused on digital tools and apps. For example, many users tweeted tips, tricks, or learning resources that might help educators with their shift to remote teaching (e.g., "Guide for using Google Classroom [hyperlink]"). The most frequently discussed tools were: Microsoft ($n=30$), Google ($n=34$), Flipgrid ($n=14$), and Zoom ($n=9$). The most popular tool-centered hashtags for these tweets included #microsoftteams ($n=4$), and #googleclassroom ($n=4$). Only two tweets asked questions about how to use digital tools, suggesting that the hashtags were not widely used as spaces for technology troubleshooting.

In addition to sharing related to digital tools, users posted general thoughts about remote teaching and learning ($n=384$; 33%), resources for parents ($n=28$; 2%), and educator self-care tips ($n=25$; 2%). The following quotes exemplify the diverse range of tweets sharing professional knowledge:

- We've got just the thing for parents/teachers experiencing #remotelearning. - #Gamification - Online games that teach for grades K-12. [hyperlink]
- Television as #RemoteLearning Tool During School Closures [hyperlink]
- There are far too many equity concerns to be grading any schoolwork done remotely. #remotelearning

These examples showcase the variety of content and messages posted in the #remoteteaching and #remotelearning spaces.

In nearly half of the tweets ($n=547$; 48%), users engaged in social sharing. Such sharing included users tweeting positive messages or humorous content, presenting their experiences as they navigated the crisis, or dialoguing with others. In 41% of the social sharing tweets ($n=225$), users posted positive messages by communicating uplifting messages, gratitude, inspiration via hashtags (e.g., #wevegotthis, #bettertogether), and via emojis (e.g., hearts, clapping hands). Several school accounts shared how proud they were of their school communities' participation in remote learning, oftentimes including pictures of teachers or students working from home. Teachers shared their successes, celebrated digital tools that were helpful to their practice, and offered positive messages to others.

Another form of social sharing was showcasing the reality of remote life as a teacher, learner, worker, or parent ($n=170$; 15%). For example, an assistant principal posted a smiling photo with his family at a table working on their laptops and a school account posted images of students at their home workspaces with the text: "A big shout out to our students, faculty, and families who continue to adapt and embrace the way we're teaching and learning. Share YOUR [school name removed] photos by tagging @[school twitter handle]." Multiple teachers tweeted photos of their new teaching setup or workspace at home.

Educators, schools, and parents also posted images of student work or students engaging in schoolwork ($n=106$; 9%). For instance, a second grade teacher tweeted an image of a student watching their Zoom lesson with the text: "#RemoteLearning is challenging ALL of us...but watching this sweet soul watch my #BFG video makes everything worth it." Nearly half of the tweets in this category were posted by teachers ($n=48$; 45%), while just over a third ($n=37$; 35%) were shared by school accounts. Both educator and school accounts' sharing of student work seemed to be

meant as a way to display success in remote teaching or express positivity about staying connected with students at a distance. For example, one teacher posted images of their students at work and the text: “The kindergartners and their parents are rocking this #remoteteaching adventure! Way to go!”

In addition to professional knowledge and social sharing, various accounts engaged in self-promotion ($n=359$; 31%). Users promoted their own work, their organization, or an organization with which they were affiliated. Examples of self-promotion included teacherpreneurs or for-profit individuals/organizations posting links to their own resources, websites, events, or blogs, and educators who identified as educational technology tool ambassadors sharing information about those tools. Self-promotion included direct selling of goods (e.g., a tweet with a hyperlink to a teacherpreneur's own TeachersPayTeachers.com store) and more indirect promotion of companies' or education influencers' brands. Nearly half of the self-promotion tweets ($n=163$; 45%) were posted by for-profit individuals or organizations, while 16% were from teachers, 13% from schools, and 10% from school support professionals. Chi-square tests of independence (with Yates' continuity correction) revealed that the likelihood of a tweet being retweeted was actually increased by a tweet coming from a for-profit account ($\chi^2 = 11.25$, $df = 1$, $p < .001$) or being self-promotional in nature ($\chi^2 = 8.7$, $df = 1$, $p < .01$). Self-promotional tweets were much more likely to share an image or video in the tweet than non-self-promotional tweets (63% vs. 49%), with a chi-square test with Yates' continuity correction showing significance ($\chi^2 = 18.83$, $df = 1$, $p < .001$).

The fourth type of action identified in the dataset was information broadcasting ($n=144$; 13%). Most commonly, users posted information about a learning opportunity, such as a webinar, a digital space for connecting with other educators, or an online course. School accounts also broadcasted information to students and their families. For example, a school account posted, “Don't forget to upload any completed work as instructed by your teachers. We'll see you at 9:10 AM tomorrow morning.” In summary, users showcased diverse purposes for tweeting with these hashtags, ranging from sharing knowledge and successes to self-promotion.

5. Discussion

With more than 36,000 combined tweets in less than two months, #remoteteaching and #remoteteaching served as spaces that various education stakeholders used to share multiple kinds of content. People and organizations invested in the common endeavor of remote teaching and learning posted large amounts of information on these hashtags, including ideas, success stories, digital tools, teaching strategies, videos, and resources. These hashtags did not, however, just serve as places for collective knowledge sharing. Educators posted about their lives, supported one another, and expressed gratitude. Additionally, various organizations and individuals used the hashtags to engage in forms of self-promotion and marketing. We consider the potential benefits and challenges of these spaces in the paragraphs that follow.

Consistent with Greenhalgh and Koehler's [27] research, our findings suggest Twitter hashtags offered affordances as ad hoc spaces where educators engaged in just-in-time knowledge and social sharing. Greenhow et al. [29] suggested that in emergency contexts, “just-in-time professional learning needs and questions surpass local PD capacity” (p. 2), and given the amount of information, ideas, resources, tools, and strategies that were being shared in the #remoteteaching and #remoteteaching hashtags, it appears that Twitter offered one means for some of those needs and questions to be addressed. Our findings can be connected to research on Spring 2020 #edchat hashtag traffic [29], as we similarly identified various forms of available support co-existing and sometimes combined with high levels of self-promotional content.

Given its flexibility, social media may remain an important venue for future just-in-time professional learning opportunities as we are “living in times of multiple and multiplying crises, some apparently slow and later, and maybe abstract, others fast and tangible and now” ([82], p. 1). In such an environment, the need for professional learning may well continue to outpace local PD capacity [21]. For example, as the U.S. Center for Disease Control and Prevention has changed their pandemic guidance for schools, and school districts have responded with new policies and practices, U.S. teachers have repeatedly had to make rapid changes to their teaching modalities. Social media spaces appear to

offer some affordances for the quick information exchange and sharing of advice that could prove necessary in such rapidly evolving contexts. Nevertheless, in a pandemic context, the just-in-time nature of social media may be a double-edged sword, as there is the possibility for “negative outcomes if educational technology quick fixes are implemented without balancing their consequences” ([72], p. 3). Also, the nature of the #remoteteaching and #remotelearning hashtags will likely change over time; neither affinity spaces nor teachers’ uses of those spaces are static [96], [104], and researchers have already identified different stages of COVID-19-era education-related use of Twitter in both Spain [5] and South Korea [3].

In alignment with Gee’s [25] conception of affinity spaces, various forms of knowledge were evident in these spaces. Given the pandemic context, many tweets featured professional knowledge related to digital tools, teaching strategies, and assessment practices in remote contexts. While educators were physically isolated from their students and colleagues, Twitter seemed to offer spaces for socializing that often happens in physical school settings. In the absence of informal faculty lounge conversations and collaborative knowledge building in teacher workrooms, the opportunities social media provided educators to interact with and support one another may have been particularly valuable, if not equal to what typically would have been available in-person.

The possible benefits associated with the #remoteteaching and #remotelearning hashtags do therefore appear to be meaningful. However, those benefits must be considered in light of challenges and shortcomings related to these spaces. The hashtags provided a variety of information and resources related to remote teaching that may have been experienced as a treasure trove by some educators and a chaotic mess by others. Additionally, resources shared in social media spaces might not be vetted or might be inappropriate for particular contexts. These spaces were also filled with for-profit individuals and companies offering their ostensible technology solutions for problems facing teachers; however, some of the challenges associated with remote learning during a pandemic cannot or should not be addressed with digital technology solutions. For example, remote teaching could be a time to shift some teaching and learning activities to more outdoor and place-based experiences [48,78]. While Twitter hashtags can provide quick access to recommendations regarding applications of particular digital technologies, educators and schools still must consider related matters of ethics, data privacy, and surveillance. The COVID-19 pandemic created a “seller’s market” ([72], p. 1) in which many teachers and schools were desperate to make remote learning work and may have neglected the deliberation, analysis, and reflection they would normally have employed around the use of new technologies. The frequent positive messages in these spaces may have resulted in educators who were struggling with pandemic challenges feeling a sense of inadequacy as they were expected to persevere or remain upbeat through a deadly pandemic. In some cases, social media have played host to relatively more negative messages, expressing critiques, fears, and frustrations related to education challenges [105], including in the COVID-19 pandemic context [3].

With the increased popularity of the hashtags during the pandemic’s early days, many educators, school accounts, and non-profit and for-profit individuals and organizations used the hashtags as spaces for different forms of self-promotion. The high percentage of self-promotional tweets with embedded images and videos also highlights efforts to carefully craft tweets that would attract users’ attention. Although accounts associated with individual PK-12 teachers comprised the single largest group ($n=365$, 32%), the next largest group was for-profit organizations or individuals ($n=299$, 26%). Given the additional presence of education entrepreneurs and private schools, these spaces played host to many tweets that had promotional or marketing aims.

All such self-promotion is not inherently dishonest or problematic [1] and it may have been interpreted in distinct ways by different users of the spaces. We, the authors, have promoted our own research by sharing it via social media. In many cases, users promoted themselves by sharing technologies, information, learning opportunities, or resources specific to, and potentially helpful for, remote teaching and learning. We did not, for example, observe tweets that appeared to be completely off-topic spam, despite such content occurring in some other popular education hashtags (e.g., tweets selling handbags or linking to pornography websites; [99]). The self-promotional content was arguably relevant to the endeavor of the affinity spaces [25], and indeed, the likelihood of a tweet being retweeted was increased when it came from a for-profit account or was self-promotional in nature. This could signal that at least some users welcomed the presence of for-profit actors and self-promotional content. However, caution is needed when interpreting

digital traces such as retweets, as users' intentions can be unclear [13], and users, including education influencers, may engage in actions to manufacture attention for postings (see [95]). Additionally, the sheer quantity of self-promotion in the #remoteteaching and #remotelearning spaces may also have been overwhelming or distracting for some users.

Some educators may feel comfortable assessing the claims made on social media by for-profit businesses or simply choose to ignore such content, while other educators may appreciate information about products sold by those businesses. For example, many school districts in the United States use Google Classroom or Google Workspace tools, and educators in such districts may perceive resources shared by Google about how to utilize those tools as helpful technology support, more than as marketing or selling. Yet, this also may indicate that for-profit companies, such as Google, continue their encroachment into educational spaces with little opportunity for educators to address a range of technoethical issues [91]. Even if some educators do not perceive self-promotional content to be particularly problematic, it may serve to further normalize a commercial intrusion in educators' professional lives in ways that impact their understanding of their roles and their profession [10]. And as Staudt Willet [71] noted, self-promotion in Twitter hashtags can be overt at times, but subtle at other times; educators may not therefore always be aware that promotion is occurring.

These varying examples illustrate how there can be overlap in the different purposes for tweeting that we described: *professional knowledge sharing*, *social sharing*, *self-promotion*, and *information broadcasting*. For example, some knowledge sharing was also social in nature and some self-promotion involved information broadcasting or knowledge sharing, too. We saw, therefore, the complex intermingling of both "intercom" and "megaphone" uses of the hashtags by some users and within the hashtag traffic as a whole ([2], para. 4).

Users' self-promotional activities should be considered alongside the commercial motives of Twitter, Inc., a for-profit company that does not have educators' wellbeing or interests as primary concerns. Scholars have previously noted how social media companies' profit imperatives inevitably influence the nature of interactions and discussions that occur on their platforms [20,90]. Twitter provides open spaces where anyone may convene, and many educators have chosen to use such spaces. However, those spaces cannot be effectively partitioned off or made private. As a result, the same Twitter features that facilitate the creation of spaces for professional learning also invite the presence of less helpful—and sometimes even harmful—content [47,61].

5.1. Limitations and implications for future research

This study had limitations that suggest opportunities for future research. First, we studied a single platform even though educators likely also used other social media platforms to navigate the disruption brought on by the COVID-19 pandemic. Studies that compare and contrast educators' uses of different social media or that explore the interconnected nature of educators' actions and learning within and among these spaces would benefit the field [94]. We also noted, for instance, limited discussion on #remoteteaching and #remotelearning about equity, privacy, or the challenging circumstances teachers faced (cf. [106]). Educators did not seem to publicly engage with these complex topics in these spaces, despite their relevance to the hashtags' foci. Research looking at multiple platforms might have revealed whether other spaces were more amenable to critical discussions of such topics, or supportive of less positive messages related to pandemic teaching.

Second, our data collection was limited to a window during March and April 2020. Although this provided rich data for describing how these hashtags were used during the time period when many schools in English-speaking countries were shifting to remote learning, future research could explore how the use of such spaces changes over time [83]. Third, because we relied upon digital trace data, we do not know for certain users' intentions for posting to these spaces, nor can we interpret what sense or use educators may have made of the content. Researchers could therefore employ surveys and interviews to better understand educators' motivations and experiences of such spaces.

Our findings point to additional fertile ground for research. There is a need to better understand education influencers in terms of their experiences and their impact on other users [70]. For example, to what degree does the presence of education influencers move these spaces towards individualistic, consumerist, capitalist cultures rather than towards

spaces of collective activism [73]? Given the quantity of self-promotional content in our dataset, researchers could investigate how users interpret and evaluate content from for-profit entities and education influencers. For example, to what extent do users simply treat self-promotional content as a necessary annoyance or inevitable part of social media use?

Researchers could also explore how social media might support educators as they navigate crisis-induced stressors while also potentially adding to teachers' anxiety by tying them more closely to reminders of the challenges they face [14]. Given the increased risk of burnout for teachers navigating crises [30], research that investigates how social media might mitigate and contribute to burnout would benefit the field. Similarly, how social media and other digital technologies help educators maintain social contact with students during crises could be studied in terms of both related opportunities and challenges (see [34,67]).

5.2. Implications for practice

Our findings have various implications for educators. First, educators who experience unexpected disruptions to their work may find that social media spaces can feature beneficial resource sharing and emotional support. Educators can use such spaces for self-directed professional learning activities aligned with their particular needs and contexts. Analysis of the content of tweets revealed that educators need ideas and resources to help them address pandemic-era challenges, and they also need spaces to express and receive support related to the emotions they confront. Hashtags can also help filter out some of the digital noise that is present on Twitter by making it less necessary to follow individuals; educators can instead give their attention to the conversations based around hashtags. However, educators must be critical consumers of the content they encounter in for-profit spaces with algorithms that can amplify problematic content. Although some content may be high quality and practitioner-vetted, educators must be aware of how much self-promotion and marketing takes place in these spaces and evaluate content accordingly. While self-directed professional learning via social media may be helpful in crisis contexts, some kinds of externally managed or mandated PD may benefit teachers as well. During crises, some educators may not be aware enough of their own needs, or they could need counseling or training in psycho-social skills [68] that may not be easily provided via social media.

Our results underscore the need for learning opportunities to help teachers navigate the social media landscape. Under normal circumstances, the education content on social media is, at times, problematic [65,97]. Amidst the cacophony of pandemic commentary and pressures of remote teaching, it may be even more difficult to assess whose voices and resources should be trusted. New media require new literacies of users [37] and many educators would benefit from support in developing critical social media literacies. Also, many teacher educators must themselves develop greater critical social media literacy to be effective role models for future teachers [47,61].

Teacher educators could also turn to services like Twitter for insights regarding educators' experiences, perceptions, and concerns during crises. More anonymous social media sites such as Reddit may also offer opportunities for scholars to hear the unfiltered voices of educators [96]. What teacher educators learn from listening in such spaces may inform the work they do with pre-service and in-service teachers.

6. Conclusion

For educators grappling with the complex set of education-related challenges associated with the COVID-19 pandemic, the #remoteteaching and #remotelearning Twitter hashtags offered access to various kinds of potentially beneficial supports. As they struggled to adjust their pedagogy and manage changes in their home lives, educators may have drawn succor from the ideas and camaraderie available to them in these online spaces. The hashtags appeared to some extent to reflect the potential of digital technologies to help connect people so that they can "discuss, learn, and tackle common problems together" ([72], p. 12). However, these hashtags also came with associated challenges. Self-promotion and commercial motivations were undeniably important parts of these spaces, and likely influenced educators' experiences. Understanding how both sharing and self-promotion co-exist in hashtags can help

inform teacher development and support considering that online spaces will likely continue to play important roles for educators throughout the full course of the COVID-19 pandemic and beyond.

Declaration of Competing Interest

None.

Appendix

Table A1, A2, A3 and A4

Table A1. Initial Codes for Tweet Content and Twitter Account Roles

Tweet Content Code	Definition
Sharing (Self-Promotion)	Tweet featured resources, links, and/or materials created by the person writing the tweet.
Sharing (Promoting Others' Content)	Tweet featured resources, links, and/or materials created by others.
Sharing (Ideas or Thoughts)	Tweet featured advice, thoughts, or links to articles with ideas.
Sharing (Technical Advice)	Tweet featured information, advice, or resources for using various tools and apps for remote teaching.
Asking Questions / Making Requests	Tweet featured a question or request for help.
Discussion	Tweet was part of a discussion thread or a synchronous Twitter Chat.
Parenting	Tweet featured resources for parents or examples of parenting.
Presenting Student Work	Tweet showcased student work.
Positive Culture	Tweet featured success stories, words of encouragement, gratitude, or motivational messages.
Remote Teaching Life	Tweet featured personal experiences related to the shift to remote teaching.
Humor	Tweet featured a gif, meme, or other intentionally funny material.
Challenges with Remote Teaching	Tweet presented concerns, difficulties, or critiques of the remote teaching situation during COVID-19.
Role Code	Definition
Teacher	Individual in PK-12 classroom teaching role, including librarians/media specialists
Administrator	Individual in PK-12 school administration role, such as a principal, assistant principal, or superintendent
School account (private)	Official institutional account (representing either the entire school or a specific department/unit) for an independent or private school
School account (public)	Official institutional account (representing either the entire school or a specific department/unit) or for a traditional public school or public charter school
Non-profit edu org	Institutional account for a non-profit organization working for such an organization.

Tweet Content Code	Definition
For-profit edu company	Institutional account for a for-profit company, individual working for such an organization, or individual that is self-employed or consulting in education.
Parent	Individual whose motivation for tweeting to the hashtag appeared to be linked to their role(s) as a parent, family member, or guardian of students who are experiencing remote learning
Student	P-20 student
Other	Account could not be identified with any of the other roles listed above

Table A2. Final Codebook for Twitter Account Roles

Role	Definition
Teacher	Individual in PK-12 classroom teaching role, including librarians/media specialists
Administrator	Individual in PK-12 school administration role, such as a principal, assistant principal, or superintendent
Other School Role	Individual in PK-12 role that is neither a classroom teacher, nor an administrator, such as instructional technology facilitator or curriculum coach
Higher Education Faculty & Staff	Individual in tertiary education role, including faculty, researchers, and instructional designers
Subcode: Edupreneur	Lists in profile information or a link (e.g., TeachersPayTeachers store site) that indicates that they sell educational materials or services
Subcode: Edtech Tool Ambassador	Lists in profile ambassador or fellow status for one or more education technology tools (e.g., Bunccee, DoInk, Class Dojo, Desmos)
Subcode: Edtech Certifications or Expertise Claims	Lists in profile certifications for education technology hardware, software, or digital tools, such as Google Certified Educator or Microsoft Innovative Educator
Public School or University Account	Official institutional account (representing either the entire school or a specific department/unit) for a traditional public school, public charter school, or public university
Private School or University Account	Official institutional account (representing either the entire school or a specific department/unit) for an independent or private school or university
Non-Profit Educational Organization or Individual	Institutional account for a non-profit organization or an individual working for such an organization. Does NOT include those currently in PK-12 teaching roles
For-Profit Educational Organization or Individual	Institutional account for a for-profit company, individual working for such an organization, or individual that is self-employed or consulting in education. Does NOT include those currently in PK-12 teaching roles
University Student	Tertiary education student, including college and graduate students
Parent, Family Member, Guardian of Student(s)	Individual whose motivation for tweeting to the hashtag appeared to be linked to their role(s) as a parent, family member, or guardian of students who are experiencing remote learning
Other	Account could not be identified with any of the other roles listed above (e.g., one tweet came from a PK-12 student)

Table A3. Final Codebook for Tweet Structure

Code	Definition	Percentage
Original Tweet	Tweet consists of content created by the user	66
Comment Tweet	Tweet re-broadcasts (retweets) another tweet and includes a substantive comment about that tweet	19
Retweet Without Comment	Tweet re-broadcasts (retweets) another tweet without adding any substantive commentary	7
Reply Tweet	Tweet replies directly to another tweet	7
Hyperlink With Image	Tweet includes a hyperlink with a preview image created by Twitter to accompany the link	14
Hyperlink Without Image	Tweet includes a hyperlink without the associated preview image	27
Embedded Media	Tweet includes an image (e.g., GIF, meme, graphic) or video directly uploaded by the user	56

Note: Percentages do not sum to 100 because tweets could receive more than one of the codes.

Table A4. Final Codebook for Tweet Content

Category	Code	Definition	Example	n=
Self-promotion	Self-promotion	Person or organization posting resources, event information, links, and/or materials that promotes their work	"Watch my new video on the 4 wins of the last 2 weeks during #coronavirus.	359
Information Broadcasting	PD opportunities	Providing information about professional learning opportunities, such as webinars and online communities	"[image for PD event] Register and tag the teachers you know: [hyperlink]"	104
	Announcements	Broadcasting a public announcement or information	"From Pres Meana, today @Unlv starts massive #remoteteaching effort to finish the semester impacting 20k students, 5000 courses, 3 profl schools."	40
Professional Knowledge Sharing	Specific digital tool/app for education	Sharing information, advice, or resources for using various tools and apps for remote teaching	"Tips for #remoteteaching: Use Google Forms for quick quizzes and checks-for-understanding."	196
	Self-care	Posting resources, advice, or information about self-care for educators, students, and/or parents	"Need some quick ways to relax & destress throughout the day? [link to Kaiser Permanente Thrive website]"	25
	General thoughts, ideas, tips, or resources	Sharing commentary, insights, questions, or resources for remote teaching.	"Our #remoteteaching efforts should be multimodal. We should have both digital and unplugged activities. What if we just asked students to complete an integrated passion project during this time?"	384
	Critiques	Presenting concerns, difficulties, or critiques of	"What We Lose When We Go From the Classroom to Zoom [link to NY Times	20

Category	Code	Definition	Example	n=
		education	article with same title]"	
	Resources for parent/families	Sharing links, materials, or ideas for parents, such as learning activities for kids.	"Brand NEW #RemoteLearning Guide - #FamilyEdTech Edition. Learn how families & learners can access & use #Buncee at home for #RemoteLearning!"	28
Social Sharing	Humor	Posting text, gifs, memes, or other intentionally funny material.	"Georgetown University is now in a #remoteteaching environment, but if you run into someone, just remember to stay 41.14 Oreos apart to meet social distancing guidelines."	42
	Student work	Sharing a picture or video that showcases student work or student activities.	"In Forest School, Jessica made a necklace out of leaves - Beautiful. □ #RemoteLearning #ManorPrep #ForestSchool"	106
	Remote life	Discussing or showcasing new experiences related to remote teaching, learning, parenting, or working life.	"#remoteworking #technology #StayHomeSaveLives #DigitalLiteracy... Never have I consulted and learn[ed] so much from Youtube #remoteteaching."	170
	Positive expression	Sharing success stories, words of encouragement, gratitude, positive emojis, or motivational messages.	"LOVING that my #IM421 students are finding amazing resources for this new normal of #remoteteaching"	225
	Challenges with remote teaching	Sharing concerns or difficulties related to the remote teaching situation during COVID-19, such as missing in-person interactions with students and colleagues.	"I miss my teaching team #remoteteaching #homelearning #thedreamteam"	47
	Chats	Posting as part of a synchronous Twitter chat session	"Q1: How are you making the transition to #RemoteLearning? Share stories. #MSFTEduChat"	53
	Asking questions or making requests	Posting a question or request for help.	"How have you facilitated group work since transitioning to #remoteteaching #distancelearning #virtualschool? My colleagues have done wonders with @padlet and @flipgrid. Looking for more ideas and tools. #edchat"	83

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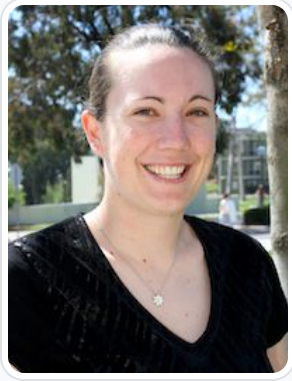




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I study educators' self-directed professional learning experiences via social media and have published on educators' uses of Instagram, Twitter, Pinterest, and Reddit. I have multiple research projects in various stages of development and can include students at different stages of the research process and in different kinds of analyses (qualitative or quantitative).



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"We are trying to communicate the best we can"

Districts' communication on Twitter during the COVID-19 pandemic

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Social Media

COVID-19

Communication

public data mining

school districts

While educators' uses of social media for purposes such as professional learning and networking are now well-established, our understanding of how educational institutions use social media—especially to engage key stakeholders during periods of crisis—is limited. In this study, we used a public data mining research approach to examine how K-12 school districts in the United States used Twitter as a communication tool during a critical period of the COVID-19 pandemic, March-April, 2020. Through a three-step grounded theory approach of 1,357 district tweets from 492 school districts, we found that the themes of messages fell into three categories, announcements, community oriented, or unrelated. Announcements were more common during the early stages of the pandemic (and were engaged with more collaboratively), with community-building posts more common later on. This study demonstrates the potential of district social media use as a communication platform and a means to impact public perceptions and support.

During the COVID-19 pandemic, unprecedented school closures required educational institutions to shift quickly to new modes of instruction ([Geiger & Dawson, 2020](#); [Gross et al., 2021](#); [Peterson et al., 2020](#)). Teachers and administrators switched instructional modalities to teach remotely, some breaking new ground by expanding the use of technology for individual students ([Malkus et al., 2020](#); [Peterson et al., 2020](#)), while others built on an established technological foundation, using school buses to provide neighborhood WiFi (e.g., [Christensen & Alexander, 2020](#); [McCrea, 2015](#)) and rolling out a more wide-spread implementation ([Al-Arshani, 2020](#)). For still others, especially in low-income areas, disparities in district funding for technology and student internet access hampered rollouts of remote learning, delaying or effectively ending synchronous instruction for the year ([Gandolfi et al., 2021](#); [Herold, 2020](#)), despite preparation and recommendations in some areas instigated after previous crises ([LaPrairie & Hinson, 2006](#)).

Communication shifted modalities as well. No longer being physically present in a school setting relegated communication between schools and their communities to the digital realm, including social media platforms. Past research inside and outside of education has shown that social media is used during times of crisis to seek information ([Austin et al., 2012](#); [Mazer et al., 2015](#); [Payne et al., 2018](#), [Stieglitz et al., 2017](#)) indicating that social media has a role in modern crisis communication, and an examination of K–12 educational institution’s social media use may provide insight into how, beginning in March 2020, they communicated about their response to the pandemic.

While the methods in which schools and educators have responded to crises have been documented ([Carpenter et al., 2020](#); [Greenhalgh & Koehler, 2017](#); [Mazer et al., 2015](#); [Thompson et al., 2017](#)), K–12 school districts’ social media-based communications—specifically their crisis responses—have been previously investigated mainly about school shootings ([Mazer et al., 2015](#); [Payne et al., 2018](#)) and for outbreaks of the *H1N1 influenza* strain ([Nasrullah et al., 2012](#)). Consequently, there is the need to understand their communication surrounding a very different—and salient—type of crisis, a long-term, gradually unfolding challenge around a global pandemic. Analyzing how school districts communicated responses to a global crisis may reveal how they desire to be seen by the community and how they prioritized different services and goals for students and their families.

In this study, we examined how a large set of K–12 institutions used social media to communicate their response during the COVID-19 pandemic. Thus, we took districts’ communication as a focal point, leveraging a large, publicly available corpus as a lens through which we could understand districts’ priorities and their changes over time. To do so, we used a public data mining approach ([Kimmons & Veletsianos, 2018](#)) in which we considered records of district posts over a crucial first few months of the pandemic as the source of data for our analysis.

Literature Review

Social Media in Education

Social media (and social networking sites, particularly) have experienced increasing scholarly interest as teachers, administrators, students, parents, schools, and education scholars have followed broader social trends of adoption and begun using these tools to communicate and share information ([Greenhow et al., 2016](#); [Greenhow et al., 2020](#)). Twitter has been heavily studied, as it is used by 22% of U.S. adults ([Perrin & Anderson, 2019](#)) and 39.7% of U.S. schools ([Kimmons et al., 2019](#)), making it a ripe space for analyzing communication between parents and school personnel.

Twitter is a social media platform that focuses on short (limited to 280 characters) *posts* that may include text as well as links, images, and hashtags. These posts are typically interacted with through a user’s *feed*, which consists of posts by those that a user chooses to follow. For the most part (as some users can choose to restrict their posts to be viewable only by those they approve), users can choose to follow any other user, making Twitter well-suited to individuals’ or organizations’ aim of sharing information with a wide audience. In addition to being well-suited to broadcasting information, Twitter also affords interactions: Users can “retweet”—share to their followers—and like other users’ posts, and can also reply to or mention other users to dialogue with them. Thus, Twitter is not only suited to sharing information (such as school-related updates) widely but also engaging with members of the school community and answering their questions. Though useful and widely used, Twitter is but one social media platform among many; while many use it, most U.S. adults do not use it, and its users may be politically more liberal than those of other platforms ([Pew Research Center, 2019](#)).

One reason that Twitter has been the focus of many studies is that its data are generally public, and it provides researchers with relatively easy access to large swathes of data.¹ Implicit in much of this new scholarly work is the idea that the benefits of tools like Twitter to educational institutions go far beyond traditional purviews of educational technology. Instead, these tools may also be having profound impacts as organizational, communication, community-building, and sharing tools ([Daly et al., 2019](#); [Greenhalgh et al., 2016](#); [Kimmons et al., 2018](#); [Kimmons et al.,](#)

2021; Rosenberg et al., 2020). For instance, before the pandemic, individuals and interest groups used social media to “frame” (Supovitz & Reinkordt, 2017) messages in such a way that may have had a substantial bearing on public support for the Common Core State Standards (Daly et al., 2019; Supovitz, 2017), with scholars noting it as a key reason for the opposition they met (Edgerton, 2020). During the pandemic, schools and districts posted the greatest number of posts of any month (since 2010) during one of the most turbulent periods of the pandemic, March 2020 (Kimmons et al., 2021). We differentiate these communicative and community building uses of social media use from sometimes controversial classroom social media use by teachers and students (e.g., Chapman & Marich, 2021; Greenhow & Gleason, 2012; Howard, 2013) as two separate uses of social media which both warrant consideration.

As another way in which social media has had an impact as communication-related tools, Kimmons et al. (2019) found that U.S. schools use Twitter to share information on a variety of topics in a primarily unidirectional manner, rather than in a way that supported or was found to be associated with two-way engagement. These and other findings suggest that educational institutions benefit from using Twitter to communicate, invite participation, and shape public discourse (Carpenter & Krutka, 2014; Greenhalgh & Koehler, 2017; Kimmons et al., 2019; Kimmons et al., 2021; Rosenberg et al., 2020; Wang, 2016; Willet, 2019). For these reasons, it is important to better understand how school districts are using these tools to engage with their communities but given the onset of the COVID-19 pandemic in 2020, the importance of such work seems to be elevated as districts have had to communicate even more quickly and adapt to novel situations and unforeseen circumstances, such as remote teaching phases.

How Districts Communicate About Their Mission and Work

Providing a range of services to students and their communities is an important part of schools and districts’ mission—including, indirectly, their academic mission (Kronick, 2002; Lucas et al., 2017; Schwartz & Rothbart, 2020). These essential services include not only meals but also include counseling and career guidance services (Falco & Steen, 2018; McKenzie et al., 2011) and community support (Hausburg, 2020), among others, which might be especially important because their functions are less-frequently studied than the instructional aspects of educational institutions. In addition to such provisions, how K–12 educational institutions communicate about and make these services known to parents and students is important. For one, such messaging framing can build or damage public and community support (Shonkoff & Bales, 2011).

How districts communicate through technology is particularly important in the present era. In a study of districts’ activity on Twitter, Wang (2016) found that communication via Twitter on the part of large school districts was comparable to how other large institutions and organizations used social media, namely, engaging the public in two-way communication: district representatives can communicate with parents and community members, and parents and community members can communicate with or respond to communications by a district representative. Other past research has demonstrated that parents hold positive views toward their children’s K–12 institutions’ communication with them when they promote effective communication (Bordalba & Bochaca, 2019). Indeed, technology is a key part of how schools and districts communicate with parents (Beeman & Henderson, 2012; Rogers & Wright, 2008), as well as how individual teachers communicate with parents (Graham-Clay, 2005; Kraft, 2017), though there is debate over educational social media use as both a communicative and community-building tool as well as one that is used by teachers and students in classroom contexts, highlighting concerns about student privacy, safety, legality, the role of capitalism in education, and mental health (Howard, 2013; Krutka, Heath, & Willet, 2019; Krutka, Manca, et al., 2019; Rosenberg, Borchers, et al., 2021; Rosenberg, Burchfield, et al., 2021).

Social Media and Crisis Communication

During periods of crisis, people rely not on information from a single source, but rather on a variety of sources including social media and traditional media (Austin et al., 2012; Briones et al., 2011; Liu et al., 2012). This research around the social media crisis communication model has elucidated who reads and potentially amplifies messages from organizations as well as what factors organizations should consider when they communicate about a crisis through social media. For previous disaster and crisis research, social media has been seen as an efficient and effective method of communication. Individuals can turn to social media to provide or find accurate, up-to-date, and personally relevant information more quickly than through traditional media sources (Palen, 2008; Palen et al., 2010; Shklovski et al., 2010).

Studies have indicated how the use of communication changes throughout a health crisis, with each of the crisis stages being associated with messages that meet their audience's needs by varying emotional tone and content ([Meadows et al., 2019](#)). A review by [Houston et al. \(2014\)](#) identified how social media is used over the life cycle of a disaster or crisis. Social media is used during the “before” stage to provide or receive disaster warnings and signal or detect crises, among other purposes. During the disaster or crisis “event,” social media is used to send or receive requests for assistance, deliver and consume news coverage, coordinate volunteering, and provide and receive information. During the “post-event” phase, social media is used to reconnect communities, facilitate discussions of causes of the crisis, and discuss implications of the crisis.

In the context of this description of how social media has been and can be used during a crisis, there are also normative accounts of how social media *should* be used by organizations during crises. [Eriksson \(2018\)](#) gleaned five lessons for using social media for crisis communication from a review of published research, including the need to take advantage of the positive attributes of social media, particularly the opportunity for two-way communication, having a social media communication strategy or plan, proactively monitoring what people are saying concerning the crisis, and continuing to use traditional communications channels. This research helps us understand what organizations like districts have done and can or should do concerning crises and social media. Next, we consider K–12 institutions’ crisis communication and what the role of social media may be for these organizations.

Crisis Communication From K–12 Institutions

Research on K–12 educational institution’s crisis communication has primarily emphasized their ability to manage the challenges (immediate and longer term) facing students and parents after an event such as a school shooting ([Mazer et al., 2015](#)) or a natural disaster ([Kubicek et al., 2008](#)). During such crises, communication with parents during a crisis is a major concern ([Kubicek et al., 2008](#)), necessitating preparation on the part of institutions to have a media plan to be able to respond quickly ([Payne et al., 2018](#)).

School districts are recommended to include social media in their crisis communication plans by researchers ([Cox, 2012](#); [Cox & McLeod, 2014](#); [Locklear, 2019](#)), and professional organizations (Centers for Disease Control and Prevention, 2014; [National Education Association, 2018](#); [Trump, 2012](#)). According to these entities, an established social media presence is vital to aid in communicating with stakeholders during a crisis ([National Education Association, 2018](#)), and is a way for districts to establish and control their public image ([Cox, 2012](#); [Cox & McLeod, 2014](#)).

While there is much research and many resources on short-term crisis response for school personnel, extended school closure due to community contagions is not included in all crisis planning resources ([Steeves et al., 2017](#); [Virginia Department of Education, 2002](#)). Therefore, any crisis management response to this long-lasting viral pandemic would likely rely on recommendations and planning for other types of crises and in all reviewed literature, there was no direct guidance about what to post specifically on social media, only that it should be used ([Cox & McLeod, 2014](#)). In summary, social media use in school communication is always recommended, including during a crisis such as the COVID-19 pandemic. But, whether and how social media has been used—and to what ends—has not been explored in past research.

Purpose

Though we believe that districts’ communication may be important, especially during a crisis, this conjecture has not been explored in detail. As an example of how and why this gap might matter, there has been some research on how meals were provided during the COVID-19 pandemic—and how districts and schools innovated to continue to provide meals during this time ([Kinsey et al., 2020](#); [McLoughlin, Fleischhacker, et al., 2020](#); [McLoughlin, McCarthy, et al., 2020](#)). However, it is unknown how districts communicated about their provision of meals to students—and whether some districts may have served students in their communities better than in others.

Social media use in education goes beyond pedagogical applications and is ripe for study, even during a pandemic, as districts communicated during the early, volatile stages of the COVID-19 pandemic, while striving to continue to provide essential services. In this study, then, our purpose is to understand the nature of school districts' crisis communication and to document how their communication on Twitter reflected or differed from those documented in past research.

More specifically, this study was guided by three research questions:

Research Question 1: What did districts communicate through Twitter during the COVID-19 pandemic?

Research Question 2: How did this communication change—if at all—over time?

Research Question 3: How did these messages promote engagement from the public?

Method

In this study, we used a public data mining approach ([Kimmons et al., 2018](#)) to access data to understand districts' responses and ways of communicating to the public during the pandemic.²

Data Sources

We utilized the Twitter Application Programming Interface (API) to collect all tweets and metadata from a preexisting list of 7,744 school-related accounts ([Kimmons et al., 2018](#)), limiting the analysis to only the 1,103 accounts that had the word "district" in their description, name, or screen name. We further limited our sample of tweets to only those that were created over 8 weeks between March 1, 2020 and April 25, 2020 to focus our efforts on the height of educational changes associated with the pandemic in the United States. Our further sampling process resulted in an analytic sample of 1,357 tweets from 492 districts from 44 states and the District of Columbia.³ See [Figure 1](#) for a map representing the locations for 403 of the districts that we could identify.⁴ We also performed descriptive statistics on the activity of districts included in our sample.⁵



Figure 1. Map of sampled districts' location.

Note. There were no districts in Hawaii included in our sample and only two districts from Alaska, and to facilitate interpretation those states were not included in this figure.

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Data Analysis

The creation of fourteen thematic codes (and three groups) comprised our primary answer to the question of how districts communicated during COVID-19 to Research Question 1. To present these themes, we described each coded theme in-depth, using our understanding of the theme that developed through the coding process to describe what the messages were about, as well as the most frequent subjects included in tweets of each theme. We also included an example message for each theme. We then aggregated quantitative descriptive results of all 1,357 tweets to understand the relative frequency and representation of different types of tweets.

Qualitative Coding Overview

To determine how districts communicated through Twitter, we used an inductive ([Hatch, 2002](#)), grounded theory ([Charmaz & Belgrave, 2015](#)) approach to qualitatively code the $n = 1,357$ tweets in our sample. To begin, we analyzed a random subsample of original tweets ($n = 670$). Coding the data proceeded in three stages: (1) open-coding, (2) axial coding, and (3) thematic coding. During *open-coding*, we wrote a summary of each tweet, focusing on using the verbiage of the tweet. For *axial coding*, we simplified the summary to a short phrase to capture the general purpose of each tweet. Through the process of *thematic coding*, we reviewed and grouped axial codes into a list of codes for our final stage before applying them to the initial data sample. Last, we grouped these thematic codes based on their similarities in purpose.

Many of the tweets contained images, video, or links or were quoting another tweet, and coding these tweets required a thoughtful approach because linked content or a video could potentially cover many more topics than the 240 character limit could convey. Our process to code these types of tweets was to focus first on the included text of the tweet if present. If there was not enough information in the tweet text, or if the tweet consisted only of a link, we examined the

additional content (i.e., followed the link to determine the content, examined the image, watched the video, or read the quote tweet text). In this way, we sought to maintain a focus on the district's intended message rather than analyzing the linked artifact. We include an example of our coding process for one tweet⁶ ([Figure 2](#)) and discuss our strategies for obtaining interrater reliability.⁷



Figure 2. An example tweet from a district's Twitter account.

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Tweet Frequency Over Time

Having examined the focuses of districts' communication, we then examined changes in the frequency of the themes across the 8 weeks (for Research Question 2). To analyze changes in messaging themes over time, we calculated the frequency of each of the codes during each week for which we collected data.⁸ We then used these frequencies in a descriptive, quantitative analysis to determine which themes were posted in different temporal ways. We identified the median date of state-mandated school closures as March 17 and treated that as a benchmark for determining before- and during-pandemic tweets ([Education Week, 2020](#)). The earliest date with a mandated closure was March 16 for many states; the latest was March 24, for Idaho.

Public Engagement With Messages

To determine the extent to which members of the public engaged with messages (for Research Question 3), we calculated the number of likes, quote tweets and retweets (combined), and replies received by each post, as well as the sum of these different types of interactions. While prior research has considered likes to reflect *receiving information* in a mode that reflects a *one-way flow of information*, from sender to receiver, replies indicate a form of *two-way engagement*, and quote tweets and retweets can represent *collaboration* on the part of the public in sharing information ([Mergel, 2013](#)); thus, these different interactions spoke to different ways the public could engage. We then grouped the messages by their theme and calculated the mean and standard deviation for the different types of interactions (and their total) for each theme. Last, to speak to whether there were differences in patterns of engagement from the public at the level of the three groups, we estimated three statistical models to determine whether there were differences

between announcement, community-building, and unrelated posts and the number of likes, quote tweets and retweets, and replies. We described the models we estimated.²

Positionality

The authors in this study are connected to the field of public education as former or future public school teachers and are involved in preparing future teachers. The familiarity with school systems was important as it allowed us to understand the context and information contained in many of the messages and how districts operate. Our experiences and access to technology, and expectations may also have predisposed us to interpret these messages in certain ways and give more weight to some types of messages, especially those that fit easily into our current schema. We addressed this through our practice of frequent group discussions about our interpretations of the messages and how they differed within the group. We did not find interpretive consensus on all tweets, though we did reach acceptable levels of interrater reliability. We see this approach as allowing for multiple perspectives and having no one person's experience and perspective serving as the ultimate arbiter.

Findings

Findings for Research Question 1: How Districts Communicated via Twitter During the Pandemic

We first present an overview of the themes and then describe each in-depth. Throughout the coding process, we found that themes fell into three overarching groups, which we used to structure this article:

- *Announcements:* Variations of an announcement containing updates and/or important information.
- *Community:* Messages focused on building or engaging with the school community through highlights of staff, students, and alumni or invitations for participation in various initiatives.
- *Unrelated or ambiguous:* Posts wholly unrelated to COVID-19 or ambiguous posts.

The themes and groups are presented in [Table 1](#).

Table 1 The Frequency of the Themes of School Districts' Posts on Twitter

Group	Theme	n	%
Unrelated	Unrelated to COVID	365	26.9
Announcements	Universal announcements	156	11.5
Announcements	Events	125	9.21
Announcements	Remote learning	109	8.03
Community	Staff highlight	108	7.96
Community	Student highlight	89	6.56
Community	Spreading positive messages	83	6.12
Announcements	Meals	80	5.9
Announcements	Health resources	57	4.2
Announcements	School closings	54	3.98
Community	Direct reply	39	2.87
Community	Community highlight	36	2.65
Community	Requests	30	2.21
N/A	Multiple	22	1.62

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As can be seen, our coding process resulted in the identification of 15 distinct themes, which ranged in frequency from comprising just more than one quarter of the tweets (for tweets unrelated to COVID-19, the theme of 365—around 27%—of all posts) to less common themes, such as community highlights (the theme for just 36, or 3%, of posts). After tweets unrelated to COVID, the next most frequently messaged themes were for three kinds of announcements, followed by three types of posts that served to build community and spread positive messages.

Next, we present the themes by group, describing each in greater detail. We anonymized the content of the example tweets.^{[10](#)}

Announcements: School Closings

Twitter was one of several methods for school districts to quickly communicate their decisions around initial dates and extensions of closings due to COVID-19. Some tweets contained specific dates or updates from governors about state-wide closings.

Announcements: Remote Learning

As school districts transitioned to new learning situations, these tweets communicated everything from both optional and mandatory remote learning resources to starting dates and remote learning practices. Others included information regarding technology distribution, the availability of wireless internet connections, and advice for internet safety.

Announcements: Events

Districts tweeted about events, including those which occurred in a different format, such as virtual Spirit Week and school board meetings, and live streaming events. This theme also contained districts' sharing of student participation in the aforementioned events. Others included tweets that provided updates on canceled events, such as field trips, athletics, concerts, and dances.

Announcements: Meals

Many students rely on schools for at least one meal during the school week, and this theme applied to tweets related to these services that schools continued to provide for students during closure. Districts shared instructions for meal distribution including eligibility requirements, times, locations, pick-up procedures, and other community resources related to meals.

Announcements: Health Resources

School districts posted advice on health and safety, including public health guidelines regarding social distancing, hand washing, and household cleaning. Tweets shared recommendations for helping students' mental and physical health, including tips for talking to students about the pandemic, mental health advice, and ways for students to remain active at home.

Announcements: Universal Announcements

This theme included broad administrative announcements on multiple topics including policies about grading practices, item retrieval from school grounds, newsletters, and updates from the school board or superintendents. Districts also occasionally tweeted information from other entities such as resources from community organizations and updates from the local and state government. Any tweet containing two or more categories that were different types of announcements was placed within this theme.

Community: Student Highlights

Posts associated with this theme include what districts referred to as senior spotlights—containing photos and information about graduating students—as well as scholarship awards, and college decisions. Other student highlights shared examples of students participating in remote learning activities such as virtual meetings, showing examples of student work, or performing community service.

Community: Staff Highlights

Districts highlighted teachers, administrators, and various other staff members for their work to support students and families. Tweets in this theme contained features of successful remote learning as well as district-wide highlights of pandemic response and community service. Also included were expressions of gratitude for work during the pandemic, including “We miss you” messages to students and “Thank you” tweets to meal providing and other staff members.

Community: Community Highlights

Districts also highlighted community members for their contributions, thanking parents and families for supporting students in their remote learning. Others expressed appreciation for school alumni, local organizations, and members of the community who contributed during the transition. These contributions included work on the front lines of the pandemic, donations of remote learning materials, and providing meals to families in the community, such as when a district highlighted an alumnus for their work as a nurse during COVID-19.

Community: Spreading Positive Messages

School districts used their Twitter platforms to spread positivity among students and families. They posted videos, images, and quotations to encourage students to stay strong during this difficult and stressful time.

Community: Requests

Districts utilized Twitter to seek out participation in various opportunities and projects. These requests included donations to local community outreach, participation in surveys, and images of students engaging in remote learning and virtual events.

Community: Direct Reply

Twitter allowed school districts to communicate with individuals in their communities directly. They were able to answer specific questions, provide positive feedback, and ask questions to engage with their parents and community members. Direct replies covered many different subjects, some of which were unrelated to the other identified themes, and thus were placed into a single category to have a consistent approach for coding.

Community: Multiple

This theme was reserved for tweets that had multiple purposes and included information falling into more than one of our categories.

Unrelated or Ambiguous: Unrelated to COVID-19

Tweets coded as unrelated to COVID included those related to another theme (e.g., announcements, athletic events) which occurred before the school district closed and/or did not mention the impact of COVID-19 or the district's response. This theme included "schooling-as-usual" tweets posted after the shutdown, including job postings, holiday observances, and nonpandemic-related achievements.

Unrelated or Ambiguous: Ambiguous

This limited theme included tweets for which it was impossible to identify a theme due to a lack of information. In one example, we saw that the district opened preschool enrollment online, but it is unclear whether this opportunity was due to the shutdown or whether online preschool enrollment was their usual approach. Because of the limited number of ambiguous posts ($n = 4$) and their unclear meaning, we did not include these in the analyses for Research Questions 2 and 3.

Findings for Research Question 2: Changes in Themes Over Time

In this section, we present findings for patterns of change in messages over time across the three groups through a descriptive analysis of the frequency of the themes by week. For the figures portraying these frequencies over time, we identified the median date on which U.S. districts closed ([Education Week, 2020](#)).

The first group we present is for the themes we considered to be announcements. As presented in [Figure 3](#), messages about school closures, remote learning, and meals, as well as the more generic universal announcements peaked in frequency on or within 1 week of the week that state-wide closures were announced. The nature of these themes reflected the use of messaging in a crisis communication manner, whereby districts shared posts that were of importance and urgency to those receiving them. Health resources and requests were posted more frequently later, suggesting that these were less urgent (or were not as salient) than the announcements that were more common around the time schools were closing. While these posts continued after closures were announced, they were rarely posted before closures, and they slowly tapered in frequency beginning around 2 weeks after most schools first closed.



Figure 3. Posts with announcement themes over time.

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The frequencies for the second group, community-building posts, are presented in [Figure 4](#). The three themes within this group that highlighted key individuals—staff, students, and community members—increased in frequency after the majority of school closures. This pattern was also observed for posts about events and those spreading positive messages. We found the themes of these posts (e.g., highlighting students) to be associated with less urgency than those that peaked around closures (e.g., announcements about school closures). These posts broadly serve the purpose of engaging the community to direct support and encouragement to those involved with the district and community.



Figure 4. Posts with community themes over time.

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The final group was for posts that were unrelated to COVID-19. As presented in [Supplementary Material 1](#) (available in the online version of this article), messages that were unrelated to COVID-19 were posted very frequently prior to when closures began. This is unsurprising; while COVID-19 was a part of the national discourse prior to the beginning and middle of March 2020, schools' daily operations were not yet affected by it—and their social media use reflected this reality. Posts with the Ambiguous theme were not included as there were only four in the data set.

Findings for Research Question 3: Public Engagement With Messages

For this analysis, we explored engagement with messages about different themes. In [Table 2](#), we present the mean as well as the standard deviation of the number of three types of interactions—likes, quote tweets and retweets, and replies—as well as their sum (the total number of interactions). [Online Supplementary Material 2](#) presents the means and standard deviations by the groups of themes (announcements, community, and unrelated) for each of the types of interactions. To interpret this table, consider the first row for school closings. Each of these posts was interacted with, on average, nearly 50 times. These interactions were mostly likes (around 28 on average), indicating that information shared by districts was acknowledged, and retweets and quote tweets (around 9), indicating a degree of collaboration in the sharing of information as well as a few replies, indicating two-way engagement ([Mergel, 2013](#)). For all three interaction types, there was substantial variation in the estimates (indicated by the standard deviations).

Table 2 The Frequency of the Themes of Districts' Messages

Group	Theme	Total interactions, <i>M</i> (<i>SD</i>)	Favorites, <i>M</i> (<i>SD</i>)	Retweets and quotes, <i>M</i> (<i>SD</i>)	Replies, <i>M</i> (<i>SD</i>)
Announcements	School Closings	48.59 (91.1)	27.78 (50.9)	18.81 (35.49)	2 (6.38)
Announcements	Meals	32 (72.43)	19.23 (39.9)	12.26 (33.09)	0.51 (1.65)
Announcements	Remote Learning	20.34 (45.86)	12.5 (30.28)	7.21 (13.3)	0.62 (3.57)
Announcements	Universal Announcements	20.24 (47.06)	12.36 (28.79)	6.63 (15.14)	1.25 (7.05)
Community	Staff Highlight	20.06 (27.62)	16.9 (23.41)	2.82 (4.4)	0.34 (0.82)
Community	Student Highlight	19.94 (31.65)	16.58 (26)	2.79 (5.07)	0.57 (2.06)
Community	Spreading Positive Messages	19.29 (28.3)	15.75 (23.15)	3.27 (6.15)	0.28 (0.65)
Community	Community Highlight	19.17 (20.67)	15.86 (17.09)	3.03 (4.11)	0.28 (0.85)
Community	Requests	15.07 (30.59)	10.57 (23.2)	3.7 (5.05)	0.8 (3.12)
Announcements	Health Resources	14.95 (25.35)	10.21 (17.97)	4.39 (7.31)	0.34 (1.21)
Community	Multiple	14.41 (15.97)	10.32 (11.19)	3.64 (5.27)	0.45 (0.6)
Unrelated	Unrelated to COVID	14.2 (48.39)	11.53 (39.64)	2.37 (7.39)	0.29 (2.14)
Announcements	Events	13.16 (25.34)	8.7 (16.06)	4.13 (9.16)	0.33 (1.21)
Community	Direct Reply	5.31 (19.03)	3.41 (12.57)	1.28 (5.79)	0.62 (1.09)

Note. There were four ambiguous posts not included in [Table 1](#). [Online Supplementary Material 2](#) shows the descriptive statistics presented in [Table 1](#) for the groups of themes (rather than the themes).

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Overall, these patterns show that a number of themes within the announcements group were interacted with very frequently, specifically school closings, meals, remote learning, and universal announcements, each of which were interacted with, on average, more than 20 times. Following announcements in the number of interactions were community-building posts, including staff, student, and community highlights, and spreading positive messages; these were also interacted with around 20 times each. There were, furthermore, differences in the specific types of interactions. Our hypothesis testing approach showed that community-building posts received more likes than announcements ($p = .013$), but that announcements were quoted/retweeted and replied to more ($p < .001$ for both types of interactions; see Note 9 for more detail). The coefficient estimates and standard errors for the Generalized Linear Models predicting the number of interactions with posts are presented in the [online Supplementary Material 3](#).

Discussion

In this study, we examined Twitter use by K–12 districts across the United States during the early—perhaps most uncertain—period of the COVID-19 pandemic. Our findings revealed that districts used Twitter in alignment with research recommendations and focused their communication on messages for one of three main purposes: broadcasting announcements, building community, and conducting regular school business that was unrelated to the pandemic. As suggested by research on social media use in crisis communication, district messaging changed over the nearly 2 months of posts that comprised our sample. Announcements were much more common in the earliest stages of the pandemic (March and early April) and community-building posts were more common in the time after schools first closed (April). Finally, while posts were, overall, engaged with by the public, the predominant mode of engagement was to acknowledge or collaborate on the sharing of posts, especially those that were oriented toward the community, rather than announcements, with which the public engaged more by quoting or retweeting or replying. In the remainder of this section, we discuss the implications of our findings and methodological approach in detail.

The Foci of Districts' Communication via Social Media

Our findings suggest that districts are purposeful and responsive in their use of social media messages during a time of emotional and societal upheaval, adjusting to the changing circumstances and prioritizing the focus of their communications with staff, students, and families. Given that the period of our data collection covered just the early stages of the shut-down, we argue that our themes represent early district communication priorities, those things that were most urgent and important to make known to the school community at a time of change and confusion. As one district (that we quoted in the title of this article) posted, "This is a situation that is evolving rapidly and we will keep everyone updated as much as possible." With the future still uncertain, districts shared what was known and temporally pertinent, following crisis communication guidelines of being open and candid. Thus, we interpret their priorities to include continuing to provide essential services and sharing crucial information directly with the community at large. Districts prioritized communication about the services they were still able to provide from a distance, particularly remote learning opportunities (8%) and meals (6%). Thus, districts prioritized services that are widely used and that have benefits above and beyond the immediate problems they solved; for example, districts continued to provide meals, which over 26 million students across the United States were eligible for in the 2019–2020 academic year ([National Center for Education Statistics \[NCES\], 2020](#)). Even during an unprecedented disruption, when districts had to obtain waivers to modify how they distributed meals ([Kinsey et al., 2020](#); [McLoughlin, McCarthy, et al., 2020](#)), districts communicated about meals to maximize their use, sharing widely and publicly the vital details for eligibility and distribution procedures on the web ([McLoughlin, Fleischhacker, et al., 2020](#)). Districts shared many timely announcements (accounting for 42% of all posts) about their updated day-to-day procedures. Districts also used Twitter to perform administrative functions by communicating about their policies during the lockdown through general announcements, comprising 12% of all messages. It is also worth noting that districts continued necessary operations, posting messages about job openings, board meetings, and new hires, all of which were coded as unrelated. This suggests that districts have information sharing as a long-standing priority with their constituents, though still, as past research has shown, in a primarily unidirectional way ([Kimmons et al., 2018](#); [Wang, 2016](#)).

Districts used messaging in a way that could build community engagement and therefore public support for education, especially through events, requests, and direct replies (discussed in the following section). Through event-themed messages, districts focused on maintaining a sense of normalcy by sponsoring virtual Spirit Weeks, contests, and other initiatives. Many requests solicited sharable content from parents (e.g., pictures of student participation in remote learning, senior pictures, or other participation challenges). However, these types of requests constituted the third lowest category, comprising only 30 messages (2%). Districts' posts may represent an appropriate balance between sharing information and two-way communication, especially during a time in which reliable information is highly valued. Districts' uses of Twitter may mirror educators', who use this single tool for several different functions, including socializing, sharing one's work (and about one's classroom), building a professional network, and crafting a professional identity ([Aguilar et al., 2021](#); [Carpenter et al., 2019](#); [Carpenter & Krutka, 2014](#); [Greenhalgh et al., 2020](#); [Kimmons & Veletsianos, 2014](#); [Rosenberg et al., 2020](#); [Trust et al., 2016](#); [Veletsianos & Kimmons, 2016](#)).

Districts prioritized messages about essential services, important announcements, and building a community presence. Taken together, these priorities suggest that districts used social media for several purposes, with one overarching potential purpose being to craft a positive presence. Among our themes, 6% of messages were noticeably focused solely on the positive, and none were negative or pessimistic in content or tone, though several acknowledged the obviously stressful and chaotic period. This is directly in contrast with Twitter accounts from other leaders who showed high levels of fear and sadness in their pandemic tweets ([Goel & Sharma, 2021](#)). In this way, districts may have been *framing* messages ([Supovitz & Reinkordt, 2017](#)) in such a way as to bolster the positive public perception of and support for their efforts during the crisis.

Changes in Communication During the Stages of the COVID-19 Pandemic

The focus and content of district messages changed over the course of the pandemic, similarly to how the communication of other institutions can change across different periods of a crisis ([Meadows et al., 2019](#)). Once states began mandating school closures, districts' Twitter messages understandably began referencing the pandemic at high

rates. That messages with announcements about policies and procedures for remote learning and meal distribution peaked soon after schools shut down indicates that districts were communicating important and likely new information during the initial stages of the crisis. Having established new procedures and expectations, these types of messages declined in the next few weeks as teachers, parents, and students adjusted to the new system. The higher volume of messages about the new procedures and policies indicates that districts had to talk more about what closing school meant than announcing that fact of the closure itself.

District messages focused more on community building after the initial stage of the pandemic. As suggested by [Mazer et al. \(2015\)](#), districts provided support in dealing with traumatic events. The shift to higher rates of positive and uplifting messages highlighting students, staff, and community members indicates motivation to accentuate the successes and build a sense of normalcy. Announcements sharing health resources, both physical and mental, peaked later in the collection period than other types of announcements, indicating the potential role of district communication approaches in dealing with future public health crises—particularly as large-scale (and, arguably unethical) experimental research studies have shown that others’ emotions expressed via social media can influence individuals’ emotions ([Kramer et al., 2014](#)). We also saw districts, in a small measure, reaching out to their several communities through recognition of diverse religious holidays and posting announcements in multiple languages. If districts are seen as trusted sources of information, their communication and policies could be leveraged to influence communities at a local level.

Crisis Communication and Public Engagement With District Posts

Twitter is typically used as a primarily one-way communication tool during a crisis ([Eriksson & Olsson, 2016](#)) and we saw that the vast majority of tweets were treated as unidirectional, though some districts encouraged two-way communication through direct replies to queries, as seen next.

Hi [name], thanks for asking! These activities involve remaining in cars and being in driveways—following social-distancing protocol.

In this way, districts evidenced some (two-way) community engagement, a strategy past research has recommended organizations use during crises ([Houston et al., 2014](#); [Seeger, 2006](#)), though these make up a very small percentage (2.87%) of the total number of tweets.

Members of the public engaged with district Twitter one-way information through liking messages, as well as engaging in bidirectional communication through retweets, quote tweets, and replies. We found relatively high (for our sample) levels of overall engagement with messages announcing closing dates and meal information, though, in terms of general Twitter engagement where a tweet might receive thousands of likes, engagement with district tweets was comparatively low. This engagement points to the information priorities of the wider school community, and the number of followers—around 2,000 per district account—suggests that many more individuals may have seen (but did not like) these posts. Taking quote tweets and retweets (together) and replies as indicators of collaboration and two-way engagement, respectively ([Mergel, 2013](#)), we saw less, but still notable engagement in these forms with tweets across both the announcement and community groups.

We found uneven patterns of engagement by message group. Leaving out the messages about school closings and meals as unique high-flyers and comparing the groups of themes in announcements and community, we saw that in general, community-focused messages had higher passive engagement and lower interactive engagement, while announcements generally had higher rates of retweets and quote tweets and replies. This may indicate that communities approved of community-building efforts by the districts—even though such posts did not represent actionable information. Informational tweets, on the other hand, represented an opportunity to amplify district messages, which viewers did through their sharing.

How Districts’ Communication Over Time Aligned With Crisis Stages

District social media use aligned with the three crisis stages as identified by [Houston et al. \(2014\)](#). In the earliest stages of the pandemic, before any shutdowns had occurred, districts tweeted about their preparations and precautions for dealing with the imminent health threat. These preparatory tweets, such as the announcement example below, fell mostly into our themes of health resources and announcements:

#[school district] COVID-19 Update: State/local agencies say no action is required at this time. Continue to use illness-prevention tactics. Soap/sanitizer are available as well as a review of excused absences/exemptions. More info: [Link]

Sharing information before a crisis fully unfolded aligns with prior research that organizations should foster partnerships with the public through information sharing in an ongoing manner to build credibility ([Center for Disease Control and Prevention, 2018](#); [Seeger, 2006](#)). We also saw many posts of this kind in our meals, remote learning, and events themes in later stages.

After the shut-down, arguably during the COVID-19 crisis “event” ([Houston et al., 2014](#)), districts encouraged volunteering through posts in the direct reply theme, facilitated donations in posts coded with the events theme, expressed emotions through spreading positive messages, and shared resources on mental and emotional health in our health resources theme. For example, the following theme shows a district expressing emotions.

We see you, hear you, and love you. And we are sorry for what you are losing right now. RT @[handle]: A message to the students of @[district account] #[district hashtag].

Though, as of the writing of this article, we are still in the throes of the pandemic and cannot technically say that we are in a fully postevent phase, we see this expression of emotion and other similar posts as examples of efforts to reconnect and build community—typically a postcrisis activity ([Houston et al., 2014](#)), as seen in the themes of making requests, highlighting students, staff, and members of the community. Community building in schools is an important element of consideration for every school leader ([Sergiovanni, 1994](#)). It makes sense that districts would consider community building a focus of their approach throughout every stage of a crisis since emotional safety and relationships are vital to any effective learning environment ([Darling-Hammond & Cook-Harvey, 2018](#)).

While we saw districts communicating about their preparations and building community during the crisis, the crisis communication literature also has found and recommends that organizations facilitate ongoing interaction with the public, outside of any crisis event ([Eriksson, 2018](#); [Houston et al., 2014](#); [Seeger, 2006](#)). While we do not have direct evidence of districts having an advance plan for how they would use social media during a crisis—a recommendation made by [Eriksson \(2018\)](#) on the basis of a systematic review of the literature—the districts we studied did have a Twitter account in use such that when the COVID-19 crisis began, they could leverage this communication channel to share timely information—which may be especially important when other means of communication were either unavailable or not rapid enough to be effective.

In sum, during this lengthy, unusual crisis, districts used social media strategically in ways that aligned with research-based practices. Though our themes did not match exactly with the social media uses, we did find uses spread across themes, over time. Specifically, the K–12 school districts we studied used Twitter to build community after the immediate crisis of transitioning to remote learning had taken place ([Houston et al., 2014](#)) and to support students through regular communication across the stages of the temporal stages of the crisis ([Eriksson, 2018](#); [Seeger 2006](#)).

Implications and Directions for Future Research

Little past research has focused on districts’ general communication on social media. This may be important given the widespread use of social media and districts’ apparent response to the widespread use of social media by extensively utilizing these platforms. Moreover, as this study showed, districts use social media for a variety of purposes. This study suggests that researchers can and should consider social media to be a context through which not only communication but also perhaps efforts to shape public perception and support for schooling, are taking place, which is notable given how public support can influence (or direct) education and educational improvement efforts ([Cohen & Mehta, 2017](#)). In this study, we used a particular public data mining approach, enabled by access to data on Twitter. Comparable programs are now available to access data from Facebook ([CrowdTangle, 2021](#)), and this study shows one example of how this data can be informative for research purposes. Particularly, this data allowed us to examine unfolding patterns in the themes of posts over time and in an in-situ way—in a way that may provide a different account than if representatives of districts were asked following the period of crisis or in the present about what they prioritized in their work and communication.

Our account of districts’ posts is largely a positive one, in that districts were responsive and communicative amid the uncertainty they faced. Nevertheless, this study raises questions that are less positive, or at least are more critical in nature: How do these communications affect the services that students receive—particularly the students who are the

most underserved in their communities and in our country? What difference does it make for districts that do or do not engage with their community through Twitter and other social media? What are districts not communicating about, including other noteworthy events of the moment? How do districts attend to their diverse audiences through social media? What role can and should two-way communication play in district social media use?¹¹ And, how effective were the changes districts and schools made during an emergency period over the coming year?

Conclusion

In this study, we examined a sample of school districts' Twitter posts during the early stages of the COVID-19 pandemic in 2020 through a process of qualitative coding and quantitative analysis. We found that districts used Twitter to share important announcements and build community through an overwhelmingly positive approach. District's community-building efforts through social media are evidence of their continued focus on this as a priority, even when physically distanced from the members of their communities. As predicted by crisis communication research, the type of posts differed across time as the pandemic's impact was realized and districts made functional adjustments to their delivery of educational services. Districts actively engaged with stakeholders through Twitter on a relatively small scale and though their posts received relatively little active engagement, they did find other ways to invite participation through sharing successes.

There remain large gaps in our understanding of district Twitter use in general, outside of the COVID-19 pandemic. We call upon other researchers to build on our efforts to document districts' and schools' responses and their communications about their responses in the years ahead with the aim of continuing to understand and support our educational system during a period of change.





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The Ecology of Study Abroad for Language Learning

Synthesis and Interdisciplinary Insights

Matthew T. Bird, Peter J. Rich, & Stephen C. Yanchar

Language Learning

Second Language Acquisition

Study Abroad

Psychology

Language

Linguistics

Research

This report presents a review of study abroad research conducted from an ecological perspective (Kramsch, 2003; Leather & van Dam, 2003; van Lier, 2004) and identifies areas of inquiry that are lacking compared to second language acquisition and other fields (i.e., linguistics, psychology). It identifies value-based views as a high-priority area of interest and draws on frameworks in other fields to outline how language learning research could effectively describe the moral ecology of study abroad for language learning.

Language learning research over the last two decades has increasingly turned to an ecological perspective to make sense of the wide variety of learner experiences across different contexts. Several edited books laid a foundation for ecological research in second language acquisition (Kramsch, 2003; Leather & van Dam, 2003; van Lier, 2004), and literature reviews since then have provided updates on the recent undertakings of the ecological movement (Kramsch & Steffensen, 2008; Steffensen & Kramsch, 2017). An ecological perspective of language learning is distinguished by its focus on complex relationships that exist between learners and their environments, as opposed to the isolated, internal workings of individuals' minds or the simple cause-effect relationships of external forces. Researchers have taken up this approach to provide holistic descriptions that generate new understandings of the learner experience. The result has been the deconstruction of prior assumptions about the process of language acquisition and socialization, agency, and other key concepts commonly considered in second language acquisition research. Language practitioners use the results of ecological research to design experiences that address the complexity of "whole people" learning a language within their "whole lives" (Coleman, 2013).

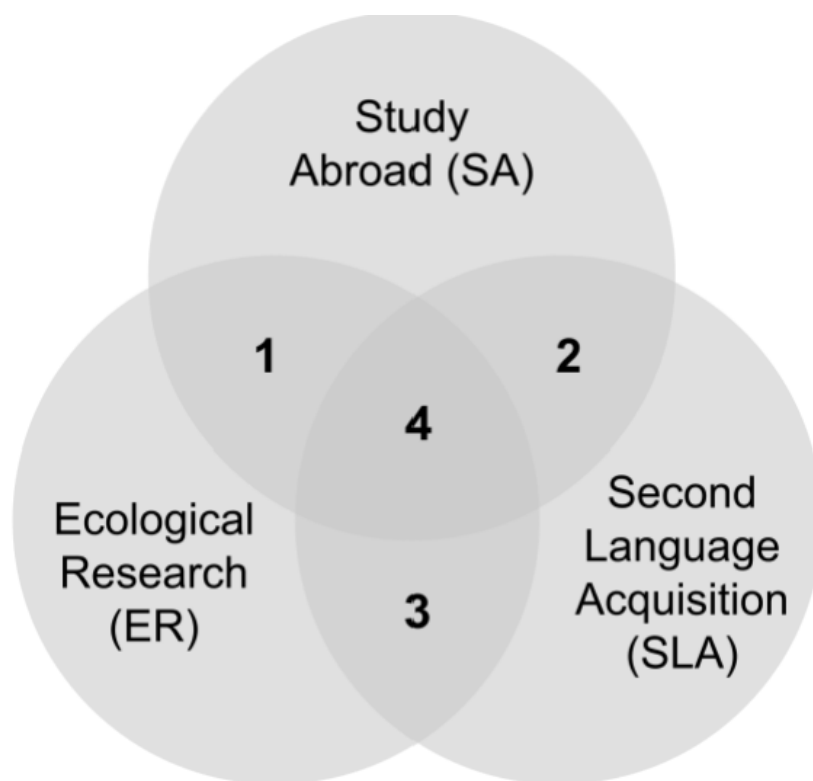


Figure 1. The intersections of three fields.

Ecological perspectives have started to affect language research specific to study abroad. At a time when “there is little consensus still on how to best define studying abroad and how to best study its effects” (McKeown, 2009, p. 106), framing study abroad in ecological terms has helped reframe concepts such as the study abroad context, participants, and the goals of study abroad. This has resulted in numerous field studies describing the relationships between diverse learners and diverse foreign contexts. However, while ecological research in the field of second language acquisition has been repeatedly reviewed (Area 3 in Figure 1), ecological research specific to study abroad for language learning (Area 4 in Figure 1) has yet to be reviewed and summarized, which could provide field-specific insights and reveal areas for further inquiry.

Additionally, ecological study abroad research stands to benefit from other fields of inquiry. So far it has drawn heavily on language research in non-study abroad contexts (e.g., SLA, sociolinguistics), but an ecological perspective also demands the consideration of other fields, since learners’ environments do not consist only of social and linguistic forces. Steffensen and Kramsch (2017) suggest that practitioners should “supplement their linguistic and sociocultural expertise with input from psychology, cognitive science, and the life sciences” (p. 23). Other disciplines can provide ideas and frameworks for answering questions about study abroad that have already started to be addressed in other fields.

In light of these needs, this paper (a) summarizes recent applied research that has taken an ecological approach to study abroad, (b) proposes future directions for ecological study abroad research in light of recent trends in SLA, and (c) presents a value-based approach to ecological research using insights from other fields.

Defining Ecology

An ecology of language learning draws on the image of a biological ecology: an expansive consideration of the organisms and aspects of an environment, with a focus on the relations of organisms to one another and to other aspects of the environment. Here each part of the ecology of study abroad for language learning is briefly defined: the

environments, the people studying abroad in those environments, and the variety of relationships they have with aspects of the environment.

First, environment denotes the broad collection of physical and social resources that people live around. Study abroad research has often referred to “the study abroad context,” but this paper will use “environment” to emphasize the ecological metaphor. The most obvious resources in an environment are often physical and close in proximity (e.g., a café down the street), but resources can also be social (e.g., discussing politics with a friend at said café) or physically distant (e.g., reading a message from a friend living far away).

Second, different terms have been used to describe people studying abroad. Referring to them as language learners, students, or participants is applicable in many cases, but from an ecological perspective these names focus too narrowly on an individual aspect of the whole person who studies abroad. For this reason, this report will refer to the protagonist of the reviewed research as the “sojourner,” a broader term denoting someone who resides temporarily in a foreign place.

Lastly, the relations that sojourners have within their environments are referred to as “affordances.” Resources in an environment are not affordances in themselves, but they afford certain opportunities for action to sojourners. They are the ways that things, people, symbols, and ideas show up to sojourners. In his 2004 work, van Lier adds that “what becomes an affordance depends on what the organism does, what it wants, and what is useful for it” (p. 252). Affordances are just as much about the sojourners as they are about the resources.

REVIEW OF ECOLOGICAL STUDY ABROAD RESEARCH

The first step in summarizing ecological research is defining what qualifies as ecological enough for consideration. In a similar review of study abroad (SA) research related to language socialization, Kinginger (2017) found that many qualitative studies reported results that contributed to a socialization perspective, but few studies took on socialization as their primary framework. The same can be said of ecological perspectives in study abroad; a number of qualitative studies have characteristics of ecological research, but few discuss their questions or present their results in an ecological perspective outright. To identify which reports qualified as ecological research, this review uses the characteristics of ecological research

identified by Steffensen and Kramsch (2017) as criteria for inclusion:

(1) the emergent nature of languaging and learning; (2) the crucial role of affordances in the environment; (3) the mediating function of language in the educational enterprise; and (4) the historicity and subjectivity of the language learning experience, as well as its inherent conflictuality. (p. 28)

For the sake of space, readers who are unfamiliar with these terms should see Steffensen and Kramsch (2017) for an in-depth definition of each of these criteria.

After identifying these criteria, database searches for English, peer-reviewed publications within Google Scholar, EBSCO, ERIC, and individual journals created a pool of 92 publications, including articles, books, and chapters from edited volumes. These were found using search terms that included variations of the criteria (e.g., subjectivity, subjective, learner perspective) and “study abroad.” Reverse searches of highly cited articles were also conducted using the same strategy. Finally, each publication was reviewed to see if it was theoretically consistent with all four criteria, regardless of whether keywords were included or not. This resulted in 54 publications for inclusion in the summary. After summarizing each publication individually with regard to the criteria, insights were combined across publications and organized temporally as they might apply to a sojourner. The themes that emerged (see Figure 2) describe sojourner experiences from an ecological perspective: (1) the interaction of sojourner and prior environments, (2) the interaction of sojourner and foreign environments, (3) perceiving affordances of the foreign environment, (4) acting on affordances, and (5) the negotiation of difference.

The Interaction of Sojourner and Prior Environments

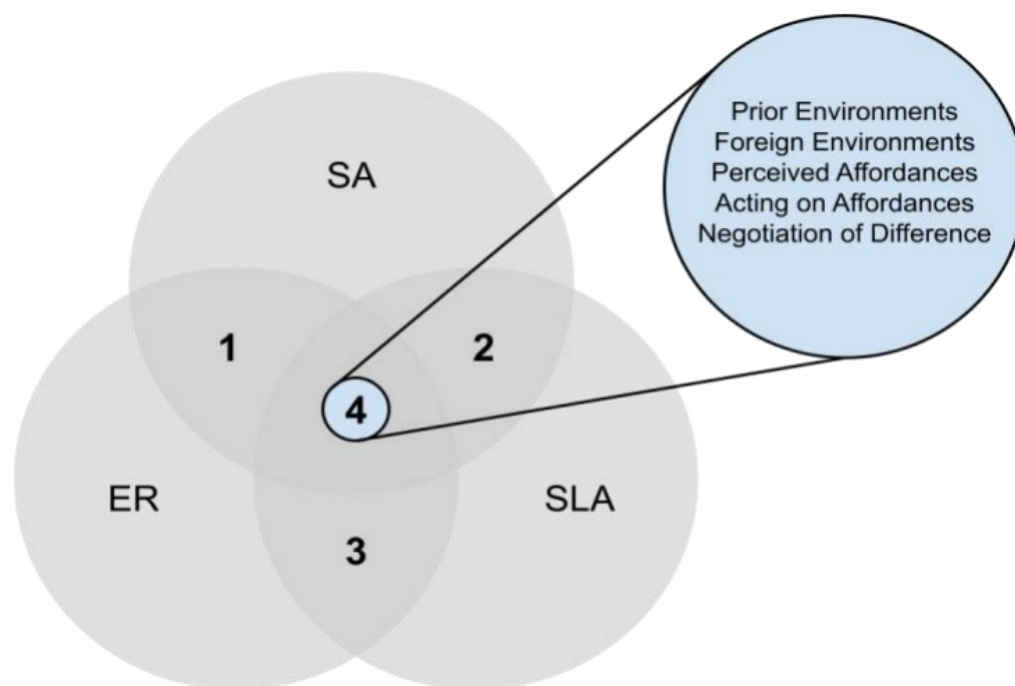


Figure 2. Themes resulting from ecological research related to language learning on study abroad.

In order to make sense of what happens during study abroad, ecological research has considered how sojourners have interacted with their environments before going abroad. These interactions were as diverse as the sojourners, since sojourners' personal characteristics (e.g., gender, nationality, sexual orientation, ethnicity, age, spirituality, religion) interacted with all the unique aspects of prior environments. Research so far has focused on macro-level discourses in which sojourners are embedded before going abroad (e.g., globalization, American exceptionalism, Confucianism, Buddhism, feminism, nationalism). These discourses are composed and communicated to sojourners (often implicitly) by many actors, including governments, businesses (Jang, 2015), and professional organizations that influence or prescribe standards for language learning; educational institutions that influence and implement policy through curriculum; families and peers who interact most often and closely with would-be sojourners; and a myriad of other groups and individuals who interact with the would-be sojourner through service encounters or informally by being nearby.

While it is probably accurate to say that sojourners are more familiar with prior environments than the foreign environments in which they study, they may not be comfortable with or conform to the norms of prior environments, even if they have spent their whole life in a "home" environment with a monolithic cultural view. The discourses that permeate prior environments do not determine sojourners' perspectives and values, but sojourners do act in relation to them, whether in favor, against, or in some other way. As sojourners travel from one environment to another, the ways that they interacted with aspects of prior environments go with them, so to speak, and inform their interactions within new environments.

For example, Diao and Trentman (2016) saw that some Americans who sojourned in China and Egypt struggled to think of themselves and their studies in ways that did not propagate American political and economic influence. Even those who might have been openly critical of American hegemony "failed to see the connection between the macro discourses they drew upon and the West's continued power and dominance over the nonWest" (p. 47). Even if they can

identify some of them, sojourners still may not understand that aspects of their prior environments (e.g., the macro discourse of American exceptionalism) color what they see, do, and become in another environment.

The Interaction of Sojourner and the Study Abroad Environment

Ecological study abroad research reveals that the epicenter of potential cultural, linguistic, and personal growth on study abroad lies at the interaction of the sojourner and aspects of the study abroad environment. Upon arrival the sojourners' personal characteristics and histories interact with the macro-level discourses and ideologies of the foreign environment. For example, in Jin's (2012) case study of Chinese compliment response strategies, having a Chinese mother seemed to motivate one sojourner to adopt Chinese strategies instead of Western ones (for similar examples, see Kinginger, 2004; McGregor, 2016; Patron, 2007; Pipitone & Raghavan, 2017). These interactions are often similar to those in prior

environments since they are influenced and communicated by similar actors, but substantial differences between old environments and the new can make it difficult for sojourners to act with the same competence and confidence as before (Jackson, 2011).

Not only can new discourses cause discomfort, but discourses from prior environments might become unfamiliar again in the foreign environment. For example, sojourners might go abroad with the intent to become global citizens, transcending one nation or culture. However, sojourners sometimes find that globalization requires more than they are willing to give, as they experience feelings of uprootedness, and rethink taking on a new identity. For example, Bae and Park (2016) described Korean families living abroad who were committed to helping their children develop international competencies, but who also became deeply concerned that their children were losing their Korean identity in the process. Globalization and other ideas can be comfortable in one environment, but become problematic once sojourners become more familiar with how they play out in real life.

Perceiving Affordances of the Study Abroad Environment

At the moment of interaction in a foreign environment, affordances emerge that guide sojourners' actions. The most widely discussed affordances of study abroad are associated with interactive contact with L2 speakers (Allen, 2010a; Brown, 2014; Liu, 2013; Siegal, 1995; Shively, 2010, 2016; Trentman, 2013; Umino & Benson, 2016). Researchers reported various kinds of interactive contact, including with host families or roommates, professional and educational socializing, service encounters, informal conversations with strangers, interest group activities, individual friendships and social circles, and even romantic relationships.

It is commonly thought that interactive contact is ideal for developing cultural and linguistic competence, and as such, study abroad programs have sought to expand opportunities for sojourners to have more of it. However, Allen (2010a), Benson (2012), Kinginger (2010), and Trentman (2013) take an ecological perspective and refute the assumption that useful affordances emerge simply when some level of access is provided to new resources. They argue that affordances emerge for sojourners according to how resources align with their abilities, interests, and the stories they tell to make sense of events. For example, host families or roommates can be physically present yet practically invisible to the sojourner as a linguistic resource. A university campus nearby with thousands of potential speaking partners might only draw the attention of the most outgoing sojourners. Proximity does not, by itself, lead to engaging interactions with L2 speakers, but requires an alignment of interests (Trentman, 2013; see also Peirce, 1995) and other qualities between L2 speakers, sojourners, and the environment where they interact.

Aligning resources in a SA environment with sojourners can be difficult if study abroad programs oversimplify sojourners' characteristics. For example, even in programs in which the primary focus is on language learning, not all sojourners position themselves as "language learners" (Kinger, 2008). Researchers have described sojourners with many different orientations to language learning while abroad. In a general way, sojourners sense whether learning the L2 has imminent value for them or not (Allen, 2010c). Upon deeper reflection, they may realize that the value of learning the L2 comes through professional qualification (Jang, 2015), fulfilment of academic requirements, cultural curiosity (Bird, 2021), or societal advancement. In other words, it is an oversimplification to classify sojourners as merely

language learners. They bring other motives with them that are primary to language learning. The L2 is often instrumental to other goals, and if resources are not properly aligned, sojourners may despair or find other ways to reach their goals than through linguistic or cultural advancement.

Another affordance sometimes taken for granted but often discussed in ecological research is the relationship between sojourners and language itself. Language is a necessary but imperfect tool for creating bridges of understanding (Kinging, 2015; Tan & Kinginger, 2013), entering into social activities (Kinging & Belz, 2005; Kinginger et al., 2014; Kobayashi, 2016), and mediating the creation of new sojourner identities (Benson et al., 2012; Diao, 2017); Language is value-laden (van Lier, 2004), meaning that those who use it have to deal with the social norms, value systems, and history related to the language. The act of choosing to use (or not use) language can be full of meaning beyond what is said or written. Even when sojourners interact with others without apparent linguistic difficulty, their acts might carry relevance or values that they did not expect. In Brown (2014), Julie thought that she was only being compassionate and helpful when she decided to sit by and interact with an isolated male student in her class. However, a misunderstanding with a different male outside of class made her change where she sat, as she feared that the isolated student might understand her compassion as romantic interest.

Instances like these are symbolic misunderstandings, pragmatic failures to communicate one's intentions and meaning. These misunderstandings may come about because of a lack of familiarity with the values involved in certain actions in a foreign environment. The more familiar sojourners become with these values generally and how people act on them, the easier it may be for them to see how L2 native speakers signal their positions within those systems and see how they can position themselves as well. As they become more familiar with the implicit values that language conveys and the discourses that frame those values, sojourners develop symbolic competence and can present themselves more intentionally and accurately in the foreign environment. Sojourners in Shively (2018) found ways to portray themselves as they wanted to be seen after they became more familiar with humor in the foreign environment. Jared, for example, used teasing to portray himself in a masculine way to his peers. He and others increased "their ability to accomplish communicative goals such as being funny and enhancing solidarity through humor" (p. 241).

Acting on Affordances

The language, interactive contact, and many other aspects of the study abroad environment present unique affordances to individual sojourners that enable action. Sojourners' growth depends on how they act on these affordances, but what actions they may take is difficult to foresee, even for sojourners themselves.

Much of the research has described various approaches to study abroad that seem to dispose sojourners towards certain actions. These approaches might be described as basic strategies for interacting with aspects of the study abroad environment. For example, some sojourners have actively avoided the discomfort of foreign cultures by seeking out familiarity abroad through compatriot socializing or communications with friends and family at home (i.e., an avoidance strategy; Wilkinson, 1998, p. 30). Some have approached their environments with white gloves on, so to speak, seeking to learn and understand with limited personal investment and risk (i.e., an observational strategy; Papatsiba, 2006, p. 111). Still others have engaged the foreign environment head-on, actively seeking to both understand and invest in relationships with L2 speakers (i.e., an integrative strategy; Isabelli-García, 2006, p. 242). Naturally, these strategies can all be seen in one sojourner over time and are not static labels of how sojourners can act on affordances.

Research has also explored how sojourners' personal characteristics and histories might relate to their use of one strategy or another. For example, a sojourner's reasons for learning a language (e.g., academic, professional, linguistic, cultural, social) could make one strategy more obvious or sensible than others (Allen, 2010b). As already discussed, discourses in which sojourners have already participated (e.g., orientalism, globalization, educational strategies) can also frame their approach to study abroad even if they do not agree with them.

The strategies that sojourners draw upon may be persistent, but they are not static. On the contrary, sojourners draw on many different strategies depending on how their characteristics fit the situation in which they find themselves (Allen,

2013). Sojourners can also have conflicting desires within themselves that ebb and flow, manifesting in contradictory behaviors in a short period of time (Allen, 2010b; Quan, 2019; Wolcott, 2013). A sojourner might begin one day with a somewhat distanced, anthropological perspective, but become emotionally engaged in new relationships by the afternoon because of interactions with L2 speakers on a personally relevant topic. A sojourner might begin their study abroad with the intent to make close friends with L2 speakers, but retreat to compatriots and class work because they became uncomfortable with the perceived values of the foreign society. These changes in motivation and approach can happen within a day or across months. Participants may drift between approaches from week to week, or they may have month-long spurts of investment in one strategy broken up by a single experience.

The Negotiation of Difference

Deciding how to act or which strategy to follow involves a continuous process of negotiation, where the subject of negotiation is the meaning of action, and the intention of negotiation is for a sojourner's actions to adequately express preferences and goals that are valid to sojourners and others in their environments (Tan & Kinginger, 2013). To make this possible, sojourners also negotiate differences among their own personal values, preferences, and emotions, especially as they see them in the unfamiliar light of a study abroad environment (Bae & Park, 2016; McGregor, 2014, 2016; Seo & Koro-Ljungberg, 2005). The research has identified several features of negotiation to describe how sojourners become familiar with new environments and start to act confidently and intuitively.

First, negotiation involves sojourners articulating their own preferences, values, desires, investments, expectations, and goals (Allen, 2010b; Bird, 2021; McGregor, 2014; Wolcott, 2013; Wolcott & Motyka, 2013; Yang & Kim, 2011). Research has most commonly seen this articulation when sojourners reflect on the tensions between their own preferences and those of others (Jackson, 2013; McGregor, 2014).

Second, negotiation involves sojourners experimenting with new ways of expressing themselves that may empower them to move forward toward their goals in the foreign environment. They do this by taking what they know about the foreign environment and trying to find common ground. They act within the foreign environment, observe the result, act again, and so on. This is apparent in short-term, repeated tasks (Kobayashi & Kobayashi, 2018), and in sojourners' long-term efforts to learn a language (Bird, 2021).

Third and finally, researchers describe sojourners carving out a Third Space that makes sense of the home environment and the foreign environment (Kinger, 2008; Smolcic, 2013). This can involve making creative arrangements in the foreign environment to satisfy sojourners' goals and desires (Benson, 2012; Bird, 2021), and it can also mean that sojourners adjust or recreate their own identity to fit into existing arrangements (Jackson, 2011). The impetus, perhaps, for the sojourner inhabiting this place between places is the impossibility of expressing themselves in the foreign environment in the exact way as they had done in prior environments. As they are prevented from engaging in the foreign environment as they might have imagined, they are constrained to reimagine themselves with an identity that is compatible with the foreign environment (Barkhuizen, 2017). Finding this Third Place may reinforce sojourners' deepest desires on which they are not willing to compromise, while also aligning with aspects of the foreign environment (Bird, 2021; Seo & Koro-Ljungberg, 2005; Trentman, 2013; Wolcott & Motyka, 2013; Yang & Kim, 2011). In Bird (2021), Chris struggled to square his introverted tendencies with an informal program expectation that he should be making friends with people in order to have better speaking experiences. Looking at the experiences of his American peers, it seemed that the best way to get good speaking practice was by becoming friends and doing a lot of hanging out, something with which he was not comfortable. Chris found, after some experimentation, that he could turn service interactions (i.e., with taxi drivers, shopkeepers, etc.) into engaging and challenging conversations. He was able to limit his social commitments and make progress toward his and the program's linguistic goals.

It is not hard to imagine that Chris's solution would be a poor fit for other sojourners or in a different context. A Third Space may be unique to the sojourner and difficult to imagine beforehand. The results of negotiation will vary for sojourners because those negotiations are mediated by the unique interaction of their personal characteristics and history with properties of the foreign environment (see Jin, 2012; Trentman, 2013). Sojourners differ in their possibilities

to act because what looks like one and the same environment will present different affordances to each sojourner (Jackson, 2008).

Summary of Ecological Study Abroad Research

Ecological study abroad research reveals the complex interaction of sojourners with foreign environments, foregrounded by interaction with prior environments and mediated by perceived affordances and negotiations of difference. Regardless of whether sojourners retreat from or engage with the foreign environment, study abroad can act as a catalyst for change in sojourners' future paths. Study abroad challenges sojourners to seriously consider and, for a period of time, live out the personal implications of learning a new language, and engage meaningfully with a foreign culture. What learners in their home countries might think of fondly as a kind of academic vacation or an on-ramp to global expertise can become an unexpectedly uncomfortable reconfiguration of sojourners' identities in an unfamiliar foreign environment. Those who retreat when confronted with this reconfiguration settle for a lesser personal change (but not no change), while those who avail themselves of the unique affordances of a study abroad environment might experience deeper personal change. This change comes about as sojourners make sense of values from prior environments, the foreign environment, and within themselves.

FUTURE DIRECTIONS FOR ECOLOGICAL STUDY ABROAD RESEARCH

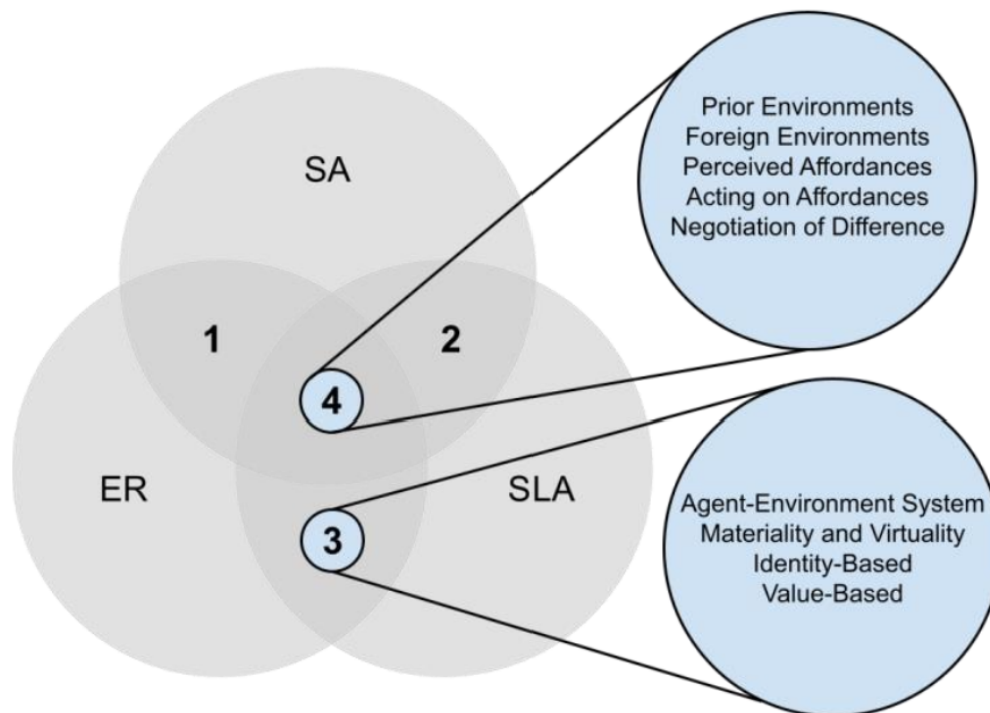


Figure 3. Considering trends from ecological research in the field of second language acquisition.

Having summarized existing ecological research for language learning on study abroad, our insights can be compared to other fields. The field of closest interest is that of second language acquisition (SLA), on which many of the reviewed publications have drawn for conceptual support (Kramsch, 2003; Leather & Van Dam, 2003; van Lier, 2004). Reviews of SLA research from an ecological perspective have identified some relevant trends that are worth considering here. For

example, Kramsch and Steffensen (2017) categorized ecological insights from SLA into different “views,” or lenses, that researchers used in their efforts to better understand learner experiences (see Figure 3). These include (a) an agent-environment systems view, (b) materiality-based and virtuality-based views, (c) identity-based views, and (d) value-based views. Here these views are briefly described, their contributions to the reviewed literature is discussed, and gaps are identified that can be filled through future research.

An Agent-Environment Systems View

Ecological SLA research has pushed back on the historical focus on the “language learner” as a bounded unit with mostly static characteristics and clearly defined paths for linguistic or cultural development. The research attempts to view people holistically, including their past history, their present relationships with the environment, and how these present possible ways to act going forward. Similarly, ecological study abroad research challenges static definitions of study abroad environments and participants, and describes the interaction of sojourner and environment in all their variety. Both SLA and study abroad research have drawn on ecological approaches (especially sociocultural ones) developed in other fields that consider the complexity and variety of experiences of learning a language. Research from this view provides detailed descriptions of sojourner experiences and highlights conflicts or affordances that would otherwise remain hidden. Overall, this view has encouraged the stakeholders of study abroad to consider sojourners on an individual basis rather than providing one-size-fits-all interventions.

Materiality-based and Virtuality-based Views

Some ecological research in SLA has begun investigations into the affordances of particular learning environments, such as online social interactions and augmented reality. They highlight Figure 3. Considering trends from ecological research in the field of second language acquisition, the constraints of different environments and the agent-environment systems that emerge when people use a second language within those environments. Augmented reality, virtual reality, and online social platforms merit ecological investigation as much as physical environments.

Given the recentness of SLA research into virtuality-based views, it may come as no surprise that ecological study abroad research has not yet provided many publications along these lines. Shively’s (2010) model for pragmatic instruction identifies possible affordances of digital tools at different points of a study abroad experience, but research so far has not taken on the task of deeply describing the material and virtual environments sojourners inhabit. Research along these lines might benefit sojourners by changing their relationship to technological resources while abroad. It may be that those who would use social media tools to virtually retreat from the foreign environment to more familiar relationships and interactions could learn to use those same tools to approach the foreign environment on safe ground. Virtual environments might be repurposed as a tool to engage rather than distract.

Identity-based Views

Recent scholarship in SLA regarding identity was deeply affected by Norton (2013), who challenged the assumption that learner identities are made up of largely static characteristics that interact predictably with other factors. Ecological research in SLA has built on her work and describes learners with multiple identities that emerge from the interaction of micro-level events and macro-level ideologies and discourses (Diao & Trentman, 2016; McGregor, 2016; Shively, 2016).

Ecological study abroad research has made significant contributions to the study of identity along these lines. Sojourners and those supporting their sojourn anticipate that studying abroad will provide numerous, consistent, and intensive interactions. However, the research shows that they sometimes do not anticipate that these interactions will significantly challenge their identities. Study abroad research provides many case studies of sojourners that affirm the findings of general SLA research that identity is context-dependent and highly dynamic. The negotiation of difference (Block, 2007) has gained traction and been further developed for study abroad environments, where differences are consistently present that require sojourners to take action and potentially adjust their self-perceptions. Given the risks taken and the investments made by those studying abroad, it behooves the field to continue developing a firm understanding of the identity changes that sojourners might undergo while abroad.

Value-based Views

Finally, recent SLA research has started to explore how the value-laden nature of language weighs on learners as they struggle to balance different expectations and social norms. Within study abroad research many reports have touched on this balance by describing sojourners' experiences with conflicting ideologies and norms (Bird 2021; Brown, 2014; Diao, 2017; Kinginger, 2004; Kinginger et al., 2014; Pellegrino, 1998; Seo & Koro-Ljungberg, 2005), but research in the field has primarily focused on identity as the unit of analysis (i.e., identity-based views) and has not clearly addressed the moral dimension of sojourners' experiences (i.e., value-based views). Future research could deeply explore the tensions and balances that sojourners maintain while abroad, providing insights relating to the negotiation of difference and sojourner identity.

Next Steps

Existing ecological study abroad research has kept pace with SLA research in some areas but less so in others. It has made meaningful contributions regarding agency and the relationship between sojourner and environment, and many authors have contributed to developing a more holistic view of sojourner identity. On the other hand, research focusing on the affordances of material and virtual environments is largely absent, and research has rarely addressed values in more than a cursory manner. While further research is probably warranted in both of these areas, some immediate progress can be made regarding value-based views.

As already described, current publications hint at a complex world of values that sojourners must navigate (e.g., ideologies, cultural norms, personal values), but analysis of these issues so far is loosely connected and lacks a clear framework for making sense of what matters to sojourners and what they have to deal with. While this paper does not report findings from a value-based view, a critical task to be completed before conducting such research is defining what values are and how to properly investigate them in an ecological way. In other words, how can language researchers understand the morality of study abroad as a whole, not just for the narrowly defined "language learner," but for everyone and everything in the environment in which study abroad for language learning occurs? Fortunately, other fields dealing with similar questions have created theories that conceptualize language and learning from a value-based, ecological perspective.

THE MORAL DIMENSION OF STUDY ABROAD

To facilitate research from a value-based perspective, this paper will briefly present common insights from two value-based accounts in different fields: Hodges' (2015) values-realizing theory from ecolinguistics and Yanchar's (2016) moral ecology of learning from psychology. The words "value," "moral," and other terms coined in these approaches (e.g., goods) do not draw on the notions of universal moral imperatives, classical ethics, or current economic, religious, or political connotations. Rather, they refer to the inherent meaningfulness of human experience and the concern involved in all human action. The following sections outline a conceptual framework by synthesizing principles presented in values-realizing theory and the moral ecology of learning. The three primary claims are that (a) values are inherent in human practices, (b) participation in practice requires the balancing of values, and (c) balancing is a kind of moral stand-taking. For a more thorough discussion of hermeneutic moral realism, see Brinkman (2010) and Slife and Yanchar (2019).

Values are Inherent in Human Practices

A value-based approach to language learning holds that values exist in practices, as opposed to existing in people's minds as psychological constructs or between people as social constructs (see MacIntyre, 1985). Humans participate in practices alongside others and using necessary equipment, and values make up the "boundary conditions" (Hodges, 2015, p. 715) that give practices form and enable interaction between a participant, other participants, and equipment. Two types of values can be identified that help define any practice.

First, there are “moral goods” (Yanchar & Slife, 2017, p. 4) that are the intrinsic ends or outcomes of participation in a practice—what the practice intrinsically yields up and, indeed, what functions as a major source of that practice’s purpose and meaning. For example, the practice of studying has the intrinsic good of learning, which could be described more specifically depending on the instance (e.g., memorizing vocabulary, refining a formal presentation, understanding grammar rules). To be clear, doing well on an exam, making friends in a study group, or finding employment are not intrinsic goods of studying, but rather are extrinsic, as they are not constitutive of the practice per se, but may occur as a kind of incidental byproduct. Moreover, they could be the goods of related practices and commonly realized alongside the goods of studying.

Second, there are “moral reference points” (Yanchar & Slife, 2017, p. 3) that guide participants in their pursuit of the intrinsic goods of a practice. Some reference points are constitutive of practices, and others might guide people to participate more effectively. For example, one cannot engage in studying without acting in relation to standards that define that practice. A constitutive reference point of studying could be honesty; to the extent that someone plagiarizes, they are not realizing the intrinsic good of studying. Non-constitutive reference points might include being well-rested and alert; these are criteria for excellent studying, but people can still study when they are tired, even if it is less effective.

These two types of values, the intrinsic moral goods and reference points that are inherent in practices, are “grounds for judgment that people encounter and must deal with in some way as they make sense of, and find direction in, the practical contexts of their lives” (Yanchar & Slife, 2017, p. 4). Without these values, practices would not exist, and people would have no bearings by which to make sense of practices and how to participate in them. Just as physical borders and landmarks demarcate countries and territories, values give shape and form to practices.

Participation in Practice Requires the Balancing of Values

A value-based approach to language learning recognizes that people commonly deal with multiple practices and values, normally without realizing or reflecting on it. Action requires not just dealing with one reference point at a time, but all reference points that are pertinent to the present practice(s) in which one is engaged. To use another physical comparison, walking through a forest entails moving in relation to not one, but many trees, and successfully navigating the forest requires orienting oneself to them. In the same way, a sojourner participating in a direct enrollment class at a foreign university might participate in group discussion, a practice with a unique landscape of moral reference points. Social reciprocity and time management might be relevant reference points that guide good group discussions, and as such, the sojourner might limit the number of comments he makes in order to respect the invested time of native-speaker students who are taking the class. The right balance of these reference points with others (e.g., speak in the target language often) would lead to realizing the moral goods of group discussion.

In familiar environments and practices, the task of balancing different values may often be smooth and not require participants to actively reflect on the values involved and how to balance them. Unfamiliar environments (or complications in an otherwise familiar environment) usually require some deliberate consideration of the values involved in a practice. For example, a sojourner may initially act at ease and could even be bored while purchasing groceries in a foreign language environment but resolving a minor complication could require unusual concentration from those involved, including an explicit consideration of the values involved in the practice of grocery shopping. For instance, if there were not enough change in the cash register, a sojourner might become consciously concerned with how to be a good customer by (a) paying a fair price, (b) acting politely to the cashier, (c) completing the transaction in a reasonable amount of time, and (d) doing all of these things within the limits of their language ability. The cashier, on the hand, might become consciously concerned with being a good cashier by (a) making a profit, (b) appeasing a customer, (c) completing the transaction in a reasonable amount of time, and (d) doing all of these things with someone who has limited language ability. Resolving the situation requires moving forward with a particular configuration of these values, with some of them taking more priority than others. Being a “good customer” or a “good cashier” in this situation requires more than linguistic expertise on the part of the sojourner and the cashier, but also familiarity with acceptable ways to balance these (and probably other) values in the moment.

This example highlights the balancing of values that might occur within a given practice, but similar balancing acts occur between practices whose goods and reference points may or may not fit together well. The customer in this example may waive the need for change, even if the price is unfair, because generosity is an important part of good citizenship, a separate practice with its own goods and reference points.

Balancing as a Kind of Moral Stand-Taking

A value-based approach also recognizes that actions constitute taking a kind of moral stand in a larger landscape of possible actions; “they are one’s judgments, whether tacit or deliberate, regarding practices worth pursuing” (Yanchar, 2016, p. 507). This is especially evident in language use:

When humans speak and listen, or write and read [...] these actions irreversibly place us. [...] To postulate a question, a statement, or even to give a grunt or a groan is to locate oneself, to take a stance with respect to oneself, to others [...] and to the geographies and tasks within which those selves are located. Actions, including those of ordinary conversations [...] cannot be done without pointing to oneself and to the responsibility entailed in speaking or listening. (Hodges & Fowler, 2010, p. 240)

Sojourners constantly situate themselves in relation to the actions of other sojourners, the programs they participate in, and the people who inhabit both prior and foreign environments. At one level, sojourners already distinguish themselves from many other language learners by engaging in the practice of study abroad. Traveling to and living in a foreign environment requires turning down other opportunities (educational or otherwise), which is a statement about the value of study abroad for sojourners and the kind of person they value becoming. At a more detailed level, sojourners within a specific study abroad experience may align with the program and other participants in some ways, and not in others. A study abroad program might provide general direction regarding how sojourners should go about best achieving the intrinsic goods of study abroad (whatever those goods are), but each sojourner will take a unique moral stand by virtue of how they manage or balance relevant values to best achieve the good of practice in a given context.

Participating in a practice and how well one performs in it is loaded with value in a larger world of practices and within a person’s life story; they say something about what is worth doing. Situating oneself in a larger moral ecology can be complicated or controversial, but it is also inescapable and potentially beneficial. “We need to disagree and agree with others in a way that moves us to enrich the physical, social, and moral possibilities of our environment” (Hodges, 2015, p. 731).

IMPLICATIONS FOR STUDY ABROAD RESEARCH

The previous section outlines what a moral ecology is made of: practices, goods, reference points, and the stances that sojourners take as they balance competing values. The final questions regarding a value-based approach to study abroad are: how does one go about conducting research from this perspective, and what could this research contribute to the field?

Researching Study Abroad from a Value-based View

To look at study abroad from a value-based perspective is to see the moral landscape that sojourners inhabit. Different research frameworks could conceivably take on this perspective and reveal the moral ecology of study abroad in insightful ways. Yanchar and Slife (2017) proposed one such framework for exploring the fit of a phenomenon (e.g., attending a direct enrollment course) in the moral space of a practice (e.g., studying abroad). In this framework they outline four general questions related to (1) the moral significance of practices, (2) the moral demands of practice, (3) the role of practices in becoming, and (4) the moral complexities that emerge within and between practices (for examples, see Gong & Yanchar, 2019; McDonald & Michela, 2019; Yanchar & Gong, 2019; Yanchar & Gong, 2020).

Moral Significance

First, what significance does a phenomenon have related to the intrinsic goods of a practice? For example, how does participating in a direct enrollment course enable or hinder realizing the goods of study abroad? Research might reveal that the course was a good fit for sojourners with a particular orientation to the goods of study abroad, whereas others experienced it as a hindrance or distraction. For the former, the course might have enabled a certain kind of study abroad experience that emphasizes certain goods (e.g., developing cross cultural relationships). For sojourners who took a different moral stand by prioritizing the goods of study abroad in other ways, the course might have been a less effective use of time spent abroad. Research could compare the direct enrollment course to other activities and discuss how they facilitated or hampered sojourner efforts to excel in the practice of study abroad.

Moral Demands

Second, what does the phenomenon reveal about the moral reference points involved in practices? For example, what evaluations do sojourners make about the different ways that people can go about realizing moral goods? Research could investigate which reference points exerted moral demands on sojourners as part of their participation in a direct-enrollment course, such as respect for authority or social reciprocity. Being a sojourner in this context may have involved tacitly prioritizing these reference points among many others. Sojourners may have acted in ways that valued efficient time use more than social reciprocity and respect for authority by speaking more than other students during discussions, ignoring or interrupting the instructor, and complaining about assignments to be completed on their own time. The way that they went about participating constituted a moral stand in relation to moral demands outside themselves.

However, sojourners' orientations to moral demands can change over time, perhaps by finding a better way to achieve the goods of practice. For example, sojourners could find that completing course assignments before they attend class enables them to participate more fully in class activities and thereby improve their linguistic ability. Yet another reason to change could be that sojourners reoriented themselves to the goods that they pursued. In other words, sojourners may have changed what they think is worthwhile about study abroad generally, which could have changed how the course fit into their experience.

Moral Becoming

Third, what role does the phenomenon play in sojourners becoming a more skillful participant in practice? To offer another example, how does participating in study abroad fit into people's efforts to become more adept language users? Research could produce a moral narrative describing how their orientation to the goods and reference points involved in language learning shifted over the period of their sojourn. Understanding sojourners' past experiences, their current efforts, and their future possibilities could frame a story of striving for excellence, with some degree of success, in the moral ecology of their study abroad program.

Moral Complexities

Fourth, what moral complexities do people struggle with in the midst of practice? How do they balance competing moral reference points, or possibly competing moral goods of different practices? If developing cross-cultural relationships is an intrinsic good of study abroad, but if sojourners find that developing meaningful relationships requires more emotional energy than they are capable of giving on a given day, how do they balance taking care of themselves with their social investments so that they can optimally realize the goods of study abroad? On the one hand, they may find ways to optimize their emotional capacity (e.g., a planned routine with dedicated personal time) and patiently keep looking for new contacts that require less emotional involvement than others they have met. On the other hand, they may retreat to a degree from social life at the expense of becoming close friends with native speakers, while other intrinsic goods of study abroad (e.g., linguistic competence) take greater precedence.

Potential Contributions of Value-based Research

The theoretical foundation and the framework discussed above provide ways of conceptualizing study abroad so that researchers can observe, analyze, and share findings from a perspective that is fundamentally concerned with what matters to sojourners as they participate in practices. Three apparent benefits stand out that this approach might offer to researchers, practitioners, and sojourners. Theoretically, this perspective enriches the ecological concept of the negotiation of differences. From a more practical standpoint, it contributes to the designing of relevant study abroad programs and helps apply insights to specific circumstances.

The Negotiation of Difference

The negotiation of difference is a pivotal concept of ecological research that brings together many other concepts (e.g., macro-level discourses, affordances, Third Space) in ways that reflect the researcher's phenomenon of interest. The types of differences that have emerged in previous publications reflect the approach of the researchers. For example, research taking an identity-based approach might discover tensions caused by a difference between sojourner personal characteristics (e.g., nationality, gender) and cultural norms in the foreign environment. Not only does this value-based approach give researchers a lens for seeing other types of differences (i.e., moral complexities), but it also adds more theoretical detail to the process of negotiation itself. Our earlier review of the process presented three parts: (1) articulating preferences, values, desires, etc., (2) finding common ground, and (3) creating a Third Space.

First, this value-based approach theorizes practices as the context in which preferences and desires (i.e., values) can be naturally articulated, and these values can be described either as practical goods that sojourners pursue, or as reference points that they consider in order to realize those goods. This description of value types and the way they are expressed in practice can provide useful mental scaffolding for sojourners as they reflect on their experiences and compare their own values with different ones in a foreign environment.

Second, finding common ground occurs as sojourners become more familiar with the values inherent in practices performed in a foreign environment. They feel out the contours of a practice (e.g., lecture-style instruction) until they understand its purpose (e.g., knowledge transmission) and common guides for achieving its purpose (e.g., memorization). Becoming somewhat familiar with a variety of practices and their embedded goods and reference points would enable sojourners to see similar practices and values in their own histories. Practices that align best with the kind of person they are striving to become would prove ideal for finding common ground.

Third, inhabiting a Third Space can be described as becoming, a kind of stance-taking regarding what is worth doing. The metaphor of a Third Space can be enriched by the spatial metaphor of a moral ecology, where sojourners position themselves in relation to other individuals and societal groups by settling on a particular way of studying abroad. Inhabiting a Third Place is a commentary on what study abroad is good for, and the process of negotiation that sojourners undergo in order to create their own Third Place is a commentary on how best to go about studying abroad.

A New Metaphor to Guide Practitioners

If practitioners intend to enhance study abroad for the benefit of sojourners, then they must know the sojourners better. Prior research has conceptualized (i.e., known) sojourners using metaphors that approximate human experience, which directly affect the kind of support practitioners provide. A computer-processing metaphor, for example, may draw attention to sojourners' mental processes and limitations, and may lead to interventions intended to reduce cognitive load or maximize knowledge retention. Many such metaphors have produced significant insights for improving sojourners' experiences and considering more than one can be beneficial (Sfard, 1998).

This value-based approach assumes a very different metaphor than those commonly seen in study abroad literature. Perhaps most centrally, it describes human beings as agents embodied in a world of meaning. It provides a detailed way of understanding human experience without proposing causal mechanisms that control human experience. Yanchar and Slife (2017) propose that "knowing who a person is, from this perspective, is to know his or her moral stance and moral becoming as a kind of commentary on moral goods" (p. 17). In other words, exploring the moral

landscape that sojourners inhabit, and knowing where they stand in it, is important to designing and evaluating study abroad experiences. While experienced practitioners may already have a sense of these things, research could make their tacit understandings more explicit (to some degree) and easier to apply.

Bridging the Theory-Application Gap

Applying the findings of research to a specific program or sojourner is rarely straightforward. Published standards and best practices are intended to guide policies and interventions, but do not often consider the complexities of real life. For example, sojourners who participate in content courses in the target language during study abroad tend to improve their oral proficiency more than those who do not (Vande Berg, et al., 2009). However, a sojourner participating in a content course may feel that recommended preparation for class discussions takes time away from other worthwhile activities, such as hanging out with native-speaker friends. How should the sojourner proceed? Should the course be given absolute priority? Probably not in all cases, but what does an acceptable balancing of priorities look like? This is one question that value-based approaches are well equipped to answer, since moral complexities describe exactly this phenomenon.

A previous example discussed the moral goods and reference points that might become salient when a cashier runs out of change to give to a sojourner customer. However trivial or mundane this may seem, a thorough investigation of what it means to be a “good customer” or “good cashier” in this situation could reveal moral configurations that future sojourners may encounter. For Yanchar and Slife (2017), the value of these insights is two-fold:

[A] researcher’s moral explication of such situations might not only reveal these moral tensions, thus providing clarification about what is actually happening [...] but also show how others have navigated the balancing process, thus providing a practical bridge between abstract and everyday ethics. (p. 18)

Sojourners, especially those going abroad for the first time, are immersed not only in a different world linguistically and culturally, but also practically and morally in the sense we have described. Their developments occur in light of intrinsic moral goods and reference points that they have to deal with in one way or another. Just as sojourners receive linguistic and cultural training before study abroad to prepare them for the linguistic and cultural ecologies they will encounter, seeing how others have effectively (or ineffectively) prioritized values in a similar study abroad environment could help sojourners to more rapidly familiarize themselves with, position themselves in, and enrich their possibilities within a new moral landscape.

CONCLUSION

This paper outlines ecological research of study abroad for language learning, identifies valuebased views as a guide for further inquiry, and proposes a framework for describing the moral ecology that sojourners inhabit. The ecological perspective of study abroad is distinguished by its focus on complex relationships that exist between sojourners and their environments (i.e., affordances), its consideration of sojourners as whole people with histories and changing identities, and its interest in how sojourners negotiate differences between their own values and those of the foreign environment. Understanding how sojourners orient themselves to the values of their study abroad environments is critical to knowing how to support them as they engage with unfamiliar cultural norms and discourses, and a moral ecology framework provides a theoretically powerful but practically simple way for researchers and practitioners to improve study abroad programming.

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Educational Psychology

A History of Research Trends from 1970 to 2020

Brett Puterbaugh, Amy A. Rogers, Meg Swanson, Katherine Zeiner, Julie Irvine, & Royce Kimmons

The purpose of this study was to evaluate and thematically synthesize educational psychology and counseling research over the last 50 years. We used bibliometric measures to identify the top 20 articles for each decade, from 1970–2019. We then systematically reviewed and coded each article, looking for thematic trends. Themes for each decade were discussed in detail. Some of these major themes included schema theory in the '70s, self-efficacy and self-regulation in the '80s, cognitive load in the '90s, motivation in the 2000s, and student learning outcomes in the 2010s. A preliminary discussion about where the field is going during the 2020s is also included. While some themes were decade specific, we found that several themes spanned the entire 50 years. Those themes included the following: (a) teachers; (b) self-concept, self-efficacy, and self-regulation; (c) motivation; (d) measurement tools and statistical processes; and (e) cognitive load. Taken together, the field of educational psychology and counseling has evolved and shifted over the last 50 years with the research bearing evidence of important themes across time.

Psychology and counseling have existed as fields of research for hundreds of years. However, educational psychology and counseling did not exist as a distinct field of study until recently. In fact, it was not until 1931 that the British Journal of Educational Psychology was established. The Journal of School Psychology was established years later in 1963. While educational psychologists and counselors existed in Britain and other parts of the world prior to these dates, they were reliant on research from other related disciplines to inform their practice. The development of these field-specific journals was a milestone that “signaled the commitment of the specialty of school psychology to wean itself from other’s [sic] scholarship and to establish scholarship that drew more heavily on its own literature” (Liu & Oakland, 2016, p. 105). Many other educational and school psychology journals were developed soon after, including Contemporary Educational Psychology in 1976, School Psychology Quarterly in 1986, and Educational Psychology Review in 1989.

Since 1931, the field of educational psychology and counseling has grown and developed as a distinct area of scholarship. A handful of attempts have been made to summarize the research using bibliometric and scientometric analysis. Three such articles provide insights into educational psychology literature but are limited due to their focus on either just one journal or just one topic each. Jennings et al. (2008) conducted a bibliometric analysis of *School Psychology International* from 1995–2007, and Mitchell and McConnell (2012) analyzed *Contemporary Educational Psychology* from 1995–2010. Jennings et al. examined citation and author trends. In contrast, Mitchell and McConnell focused on thematic and theoretical trends in the articles published during the 16-year period. According to their analysis, the most common topics in articles published in *Contemporary Educational Psychology* from 1995–2010 were motivation and academic subjects, particularly reading and math. Mitchell and McConnell (2012) also reported that the theoretical perspectives most often discussed in *Contemporary Educational Psychology* were cognitive and social cognitive theories.

More recently, Graves et al. (2020) published a bibliometric study in which they extended their analysis to a total of nine educational psychology journals; however, they focused strictly on the singular topic of social justice. Thus, while the article provides unique insight on a relevant topic in educational psychology, it does not give a comprehensive view of the field as a whole.

A few other studies have attempted more comprehensive analyses of educational psychology and counseling literature and are summarized here.

Price et al. (2011) reviewed five educational psychology journals and identified the top 100 most cited articles of all time and the top 25 most cited articles from the previous decade (2000–2010). They specifically analyzed article type and content topics. Price et al. (2011) reported that these articles were 50% qualitative and 50% narrative, with no quantitative studies represented. Six broad content categories were identified: (a) 23 assessment articles, (b) 27 intervention articles, (c) 29 explicative articles (“Explicative articles describe the relations between two or more phenomena or variables” [p. 65]), (d) 12 professional issues articles, (e) 10 consultation articles, and (f) one other article. While similar to our present study, one weakness to be considered is that identifying the most cited articles of all time favored more recent articles to historic ones; thus, articles published prior to 1990 would have been underrepresented in Price et al.’s analysis.

Kranzler et al. (2011) conducted a somewhat similar study researching the publications of school psychology program faculty from 2005–2009. They did not limit their study based on journals; rather, they selected publications by faculty from 59 selected school psychology programs. The majority of their analysis focused on faculty scholarship, but they included a brief discussion on the topics most represented. Similar to Price et al. (2011), they found the majority of the articles could be categorized as professional issues, intervention, assessment, and consultation (Kranzler et al., 2011).

Finally, Liu and Oakland (2016) completed a scientometric analysis of all the articles referencing “school psychology” from 1907–2014. Using this data, they identified 4,806 scholars authoring 3,260 articles in 311 journals. The most prominent publishers and various citation relationships were discussed in depth. Liu and Oakland briefly discussed relationships between the most highly cited articles. These relationships are very similar to those mentioned by Price et al. (2011) as “the top 15 most highly cited articles in this study, are also included in Price et al.’s list” (Liu & Oakland, 2016, p. 118).

Our study builds on and adds to the existing literature by providing a deeper, topical analysis of the research in the field of educational psychology over the last 50 years from 14 journals. We identify and discuss trends and themes associated with the 20 top cited articles for each decade from 1970–2019, with a short section dedicated to the top trends in 2020 and moving forward. Of the 14 journals represented, three are broadly related to the fields of educational psychology and counseling: (a) *Journal of Counseling Psychology*, (b) *Counselor Education and Supervision*, *Learning and Individual Differences*, and (c) *Journal of Counseling and Development*. The majority and remainder of journals are specifically educational psychology journals, including the five listed at the beginning of this chapter. A complete list of the journals utilized in our analysis can be found in the Appendix A. A more thorough explanation of our analysis methods can be found in the “Methodology” chapter of this book.

1970s: Motivation, Teachers, Math Anxiety, and Schema Theory

The top articles in this decade centered around four main themes: motivation, the impact of teachers, math anxiety, and schema theory. We saw schema theory and motivation develop as themes throughout almost every decade of top cited articles in this chapter. Other topics from research in the 1970s touched on the role of randomized control trials in education psychology, how to properly determine interrater reliability, and how to improve the happiness of students.

Motivation, Effort, and Attribution of Students

The second-most cited article from the 1970s explored a topic that was discussed by two other articles in our analysis: motivational underpinnings of students in a classroom. In this article, Weiner (1979) elaborated on the attributional theory of motivation and how it related to different situations that students may face in the classroom. Attribution theory focuses on a learner being able to look back and understand why success did or did not occur. There is a direct connection between a student's future motivation and what they attribute to their success or failure as a learner in the classroom. If a student perceived they failed due to lack of effort, then they may be more motivated to try again because they believe they can adjust the effort variable. If the cause of failure is believed to be external to the learner, then the learner's motivation will decrease substantially. This theory was meant to augment the contemporary theories of motivation that primarily focused on pleasure seeking and pain avoidance.

Another top article went into more detail on effort and how it played into student-teacher interactions and student motivation. "Effort: The Double-Edged Sword in School Achievement" (Covington & Omelich, 1979) discussed the way that effort affected student-teacher interaction and student achievement in a classroom. According to Covington and Omelich, teachers tend to praise and place a high value on effort and even threaten students if they do not try. For students, however, effort can have a large impact on how they feel about themselves and their self-confidence. If students exert significant effort and still do not succeed, then they infer low ability in themselves and feel discouraged. However, if they do not try hard and do not succeed, then at least they can use their lack of effort as an excuse. Thus, students sometimes may not give their best effort to preserve their sense of self-worth.

Two other articles touched on similar topics. One evaluated a chicken-or-the-egg question in academic performance and found that academic achievement clearly precedes a student's evaluation of their ability, rather than the other way around (Calsyn & Kenny, 1977). The other article evaluated the logic of student attributions at different age levels and found that as students mature in elementary school their attributions of failure or success become more logical (Nicholls, 1979).

Teachers

Research in the 1970s was important for understanding the impact of teachers. Previous research centered around the idea that academic achievement was "determined by factors within students, little if at all by teachers" (Brophy, 1979, p. 733). This belief started to change throughout the decade as more and more researchers demonstrated that how a subject is taught can have as much significance as the subject matter. Teachers have an important role to play, but it can be difficult to fully understand that role given the myriad variables at play in any given classroom. Brophy attempted to navigate many of these variables and give direction to the field on how to approach research given the changed landscape of education. To do this, Brophy argued effective compilations of research and data need to be made, and eventually generic conclusions about teaching in a classroom need to lead to specific studies designed within specific contexts.

One of Brophy's (1979) discussed variables was teacher expectations on classroom performance. Brophy and Good (1970) studied the interactions of teachers and students in four different first-grade classrooms. The observations focused on the behavior of the teachers and the students. They noticed that some of the differences between the behaviors of various teachers was caused by student behavior, while other differences in teacher behavior could not be attributed to the behavior of the students. Teachers gave the greatest praise to students whom they had the highest expectations of. Brophy and Good concluded that teacher expectations of students are in some ways self-fulfilling prophecies.

Measurement: Math Anxiety

Two articles discussed the introduction and subsequent use of a scale designed to measure the level of anxiety students experience with learning math. The first article explained how a psychometric test (called the Mathematics Anxiety Scale) was developed that demonstrated internal reliability and predictability when it came to measuring the level of anxiety a student felt about math (Richardson & Suinn, 1972). A follow-up article in 1978 sought to understand how common math anxiety is among college students using the Mathematics Anxiety Scale (Betz, 1978). That study found that math anxiety is relatively common among college students but also noted that it is more prevalent among certain subgroups of students, such as women and students who did not have as much math education in high school.

Schema Theory

During the 1970s, schema theory became more developed and robust, which is reflected in the sixth- and seventh-most cited articles. Schema theory states that when learners are introduced to new material they must assimilate it into their preconstructed understanding of a subject or broader understanding of the world. Wittrock (1974) discussed a model that can be used to try to better understand human learning. Learning, as proposed by the author, is better understood when looking through the lens of the previous knowledge of the learner. Learners generate understanding and recall from what they construct of the material learned and how it fits into the bigger schema that the learner has already preconstructed in their brain.

This concept was later tested by Pichert and Anderson (1977). Their study tested how well college students remembered different elements of stories based on the perspective they were given in reading the story. The results showed that the perspective the students were given influenced their recall of particular ideas. That is, the perspective of the student determined the importance of the ideas. This meant ideas are not important in and of themselves but rather are important depending on the perspective the person brings to the text.

Other

The most often cited article from the 1970s was “Estimating Causal Effects of Treatments in Randomized and Nonrandomized Studies” (Rubin, 1974). It has been cited in almost three times as many instances as the second-most cited article, with 3,345 citations as of the writing of this chapter. This article addressed some of the criticisms that had been levied against the field of education psychology—mainly, that the field does not utilize randomized control trials as much as it should. The authors argued that there is merit in randomized control trials, but in many instances such trials are not feasible. Given the meta-issue addressed in this article, it is logical that it is still frequently cited. However, it is the only top-20 article that addressed this topic. Authors who cited this article list it as one of the founding arguments making the case for exceptions to randomized control trials and how to work with situations where randomized control trials are not feasible (Holland, 1986).

Other top articles from the 1970s introduced and developed many other important subjects that are prevalent in today’s understanding of learning. Methods for calculating interrater reliability and agreement were more fully developed (Tinsley and Weiss, 1975), and the first psychological study designed to improve human happiness among college students was also conducted (Fordyce, 1977). These topics, as well as the themes mentioned above, are a reflection of larger trends that took place during this decade.

1980s: Self-Concept, Self-Efficacy and Self-Regulation, Motivation and Goals, Longitudinal Studies, and Measurement Tools

In comparison to the 1970s, the most cited articles from the 1980s focused less on the impact of teachers (though there were still some articles in the early ’80s with that theme) and more on the impact of the individual, their sense of self, and their performance. Self-concept, self-efficacy, self-regulation, and self-motivation were prominent topics

among the most cited articles of the '80s. There were also a number of highly cited articles covering longitudinal studies as well as articles aimed at advancing various measurement and analysis tools.

Self-Concept

Throughout the '80s, many authors, but particularly Marsh, sought to study self-concept and its impact in various areas. In the mid-'80s, Marsh and Shavelson (1985) focused broadly on breaking down the multiple areas of self-concept by compiling existing research. The factors considered and rated in their effects on an individual's self-concept were verbal skills, problem solving, appearance, parents, religion, and emotional stability, along with various other factors.

Later, Marsh (1987) aimed to investigate the practicality of the "big-fish-little-pond effect" (the BFLPE) in students. In this longitudinal analysis, he focused on children's academic self-concept and subsequent academic performance. Marsh was able to use the BFLPE to conclude that a student's academic self-concept could be shaped positively or negatively depending on whether they were placed in a higher or lower ability school. For example, an average student placed in a high ability school was at risk for developing poor self-concept and performing poorly academically.

Towards the end of the '80s, Marsh (1989) published a widely cited study analyzing how gender and age shape self-concept in preadolescents. He found that self-concept declined in middle-adolescence through early adulthood. According to Marsh (1989), younger children's self-concept is unreasonably high, and the subsequent decline in self-concept is a naturally occurring process as children become more aware of themselves in relation to their environment. Self-concept was also observed to increase again in adulthood (Marsh, 1989).

Self-Efficacy and Self-Regulation

Two more popular themes from the '80s, self-efficacy and self-regulation, attracted various authors. Towards the beginning of the decade, Betz and Hackett (1981) investigated the applicability of Bandura's self-efficacy theory and sought to apply it to the career decision-making process for women in particular. The authors found that women reported lower self-efficacy in regards to traditionally male positions such as engineer, accountant, mathematician, and police officer. In contrast, women reported higher self-efficacy in traditionally female positions such as elementary teacher, dental hygienist, and secretary. The authors concluded that self-efficacy could influence career development. Betz and Hackett recommended the development of programs aimed at increasing self-efficacy in women regarding traditionally male jobs.

Self-efficacy in teachers became the topic of Gibson and Dembo's 1984 article. The authors aimed to develop an instrument to measure teachers' self-efficacy and study it in relation to observable teacher behaviors. High- and low-efficacy teachers were divided up based on this measurement tool. The authors observed that low-efficacy teachers spent more time in small groups, intellectual games, and giving feedback in the form of criticism. Low-efficacy teachers also lacked persistence in helping the student figure out answers for themselves. High-efficacy teachers, in contrast, spent less time in small groups, more time preparing paperwork, and did not give any feedback in the form of criticism. High-efficacy teachers were also more likely to persist in getting a student to an answer, rather than just giving them the answer, for example.

Also in 1984, Salomon published an article investigating television versus print as learning media. The author sought to understand whether the medium affected the individual in terms of the amount of invested mental effort (AIME), perceived self-efficacy, and subsequent achievement. The author reported that individuals with higher levels of self-efficacy expended less mental energy and achieved less when presented with television content. On top of that, children, in general, felt more efficacious with television content as a whole. Thus, Salomon (1984) concluded television content could be assumed to be "too easy" in comparison to print media in providing effective learning experiences.

In the late '80s, Zimmerman (1989) sought to determine the effects of the following variables in the self-regulation of K-12 students: (a) self-efficacy, (b) self-observation, (c) self-judgment, (d) self-reaction, (e) personal influence, (f) behavioral influence, and (g) environmental influence. The author found that telling students the group before them had completed X amount of problems or recommending that students complete X amount of problems resulted in students

displaying higher self-efficacy and performing better than the control group. Furthermore, children who were encouraged to self-record reported higher self-efficacy than the control group. Additionally, Zimmerman (1989) found that a child's selection of learning strategies determined whether they would continue to self-regulate via those learning strategies.

Finally, Grolnick (1989) authored an article focusing primarily on self-regulation. Grolnick (1989) sought to evaluate parental style and its subsequent influence on children's self-regulation. The author assessed multiple variables, and key factors emerged. Areas such as combined parental support of autonomy positively correlated with children's self-regulation and, additionally, appeared to help keep children from acting out in school. Grolnick also noted that a healthy parent-to-child control balance was necessary for children's own internal regulation.

Motivation and Goals

Similar to the 1970s, the '80s were still concerned with motivational factors and the structuring of goals. In 1983, Paris et al. (1983) examined the motivational factors they deemed critical to an individual becoming a "strategic reader." The authors determined that the personal significance of the goal, its meaningfulness, the social contexts of setting the goal, and the intentions of the goal-setter were important factors in self-guided and self-motivated learning.

Five years later, Meece et al. (1988) analyzed students' cognitive engagement as related to science activities. According to the authors, students who were motivated to focus on goals around task-mastery reported being cognitively engaged. In contrast, students who aimed to achieve goals centered around social recognition or avoiding excess work reported being less cognitively engaged. Therefore, motivational goals centered around task mastery would lead to greater cognitive engagement. The authors further linked these results to the students' self-motivation and enthusiasm for science.

Also in 1988, Ames and Archer (1988) sought to understand the effects of mastery goal orientation (attaching importance to learning a new skill) vs. performance goal orientation (attaching importance to ability to succeed) in instruction. According to the authors, mastery goal orientation resulted in students "using more learning strategies, preferring tasks that offered challenge, and having a more positive attitude towards their class" (p. 263). Performance goal orientation, on the other hand, was linked to mildly negative "self-perceptions of ability" (p. 263). The authors' findings indicated that classroom environments emphasizing mastery positively changed the way that students approached tasks and engaged in learning.

Lastly, we give a special note to the 1984 study conducted by Solomon and Rothblum (1984) investigating procrastination. In a study of the antithesis of motivation, the authors aimed to discover the reasons for procrastination and frequency of procrastination among college students. According to the authors, factors such as fear of failure and aversiveness of task were the main reasons accounting for procrastination. These factors also correlated with self-reported depression, anxiety, low self-esteem, and other similar mental disorders.

Longitudinal Studies

Of the 20 most cited articles of the '80s, two were longitudinal studies. Juel's (1988) study tracked the reading development of a group of students from first through fourth grade. Juel aimed to find out whether children remain poor readers and poor writers over the span of multiple years. The author also intended to determine what skills poor readers lack and what factors keep poor writers from improving. According to Juel, a child's poor reading ability at the end of the first grade was a reliable indicator of the child continuing to remain a poor reader by the fourth grade. Additionally, there was a tendency for poor readers to become poor writers. In terms of influential factors, entering the first grade with little phonemic awareness was a common factor among the poor reader group.

In the second longitudinal study of the list, Gottfredson (1981) focused on four different life stages and evaluated how an individual's evolving self-concept affected their occupational aspirations. The various stages that Gottfredson observed were "orientation to size and power (ages 3–5 years), orientation to sex roles (ages 6–8 years), orientation to social valuation (about ages 9–13 years), and orientation to the internal, unique self (beginning around age 14 years)"

(p. 545). According to the author, a child's sense of self-concept (in relation to their gender and level of prestige) and subsequent career aspirations begin to set in by age 13. And, after age 13, adolescents experience difficulty in deciding what career options to pursue. This is due to the fact that they have little idea of what they like to do or what they are good at. Therefore, the author suggested career counseling take place earlier in the child's life and adolescents be assisted in discovering careers and skills through self-discovery tools.

Measurement Tools

Various measurement tools were introduced in this decade. In the early '80s, Rosenthal and Rubin (1982) introduced the binomial effect size display (BESD). This tool was aimed to more accurately account for changes in success rate as "attributable to a new treatment procedure" (p. 166). Also in 1982, Heppner and Peterson investigated the validity and application of the problem-solving inventory (PSI), which, according to the authors, was "a 6-point, Likert-type format of 35 items constructed by the authors as face valid measures of each of the five problem-solving stages, based on a revision of an earlier problem-solving inventory" (p. 67). The authors further suggested that the PSI may be useful as an indicator of an individual's perception of the problem solving process and their ability to conceptualize ways to solve hypothetical problems.

Tinsley and Tinsley (1987) furthermore introduced the factor analysis technique with the goal of explaining the maximum amount of variance using the least amount of "explanatory concepts." Lastly, Horvath and Greenberg (1989) authored an article on the Working Alliance Inventory (WAI), which measured client counselor relationships. Study data suggested that the WAI demonstrated promise in early prediction of successful counseling outcomes. However, its validity, reliability, and utility were still in the early stages.

1990s: Self-Efficacy, Motivation, Schemas, Cognitive Load, Counseling Relationships, and Knowledge

Some of the major themes in the 1990s included self-efficacy, motivation, cognitive load (which was grouped with similar topics such as schemas and working memory), counseling relationships, and knowledge. This continued the trend of self-efficacy from the 1980s while bringing in more work on counseling and relationships, cognitive load, and motivation.

Self-Efficacy

Self-efficacy, according to Bandura (1993), is the belief in one's own ability to excel in academic activities through the use of various cognitive strategies. These strategies are determined by the degree to which the learner is motivated, their goals, and their previous academic record. Has the student accurately predicted in the past how well they will do on an assignment? Did an employed strategy help the student to feel that they performed well on a specific activity? Having high self-efficacy helps learners exert more control over their own learning. With this quasi-definition in mind, Bandura and several others wrote well-cited articles regarding self-efficacy and self-regulation, including the article with the most overall citations from this decade by Pintrich and de Groot (1990). This empirical study researched the three components that make up self-regulation: student metacognition, student self-management, and control of one's own effort in the classroom. Tips and tools were brought up that can help students to develop strategies to help with their learning processes.

Most of the other articles in this theme are theoretical. Blumenfeld et al. (1991) discussed the implementation of problem-based learning as well as offering help to those who are looking for the motivation to sustain that implementation. Elliot (1999) expounded on approach and avoidant motivations and whether or not these should be included in the conversation on achievement goals when it comes to performance goals. Zimmerman (1999) explored the interplay between motivation and self-efficacy. Schunk (1991) also discussed the interplay between self-efficacy and motivation when writing about the academic motivations of students. Self-efficacy continued to be an important theme in the field of educational psychology as researchers focused on students and student-centered learning.

Motivation

Motivation continued to be a theme in the literature. As mentioned above, Schunk (1991) discussed the impact of different types of motivation (approach and avoidant) on the goals that a student sets. Blumenfeld et al. (1990) discussed problem-based learning and how to implement, sustain, and motivate its use in the classroom. Skinner and Belmont (1993) studied the relationship between the teacher's classroom (i.e., structure, involvement, and autonomy) and student engagement, both in behavior and emotion. Deci et al. (1991) reviewed existing literature to see the role of motivation in the classroom, how it is created, and what types of motivation exist. Zimmerman (1990) and Schunk (1991) were both mentioned in the section on self-efficacy and wrote about similar facets of the interplay between motivation and self-efficacy. They both focused on how self-efficacy can play a role as a motivator in academic settings. The final study on motivation in the top 20 was based on an experiment conducted by Cordova and Lepper (1996) in which they analyzed the effects of personalization and contextualization on the learning of students who were practicing mathematical problems on the order of operations.

Cognitive Load

Several '90s articles spoke of creating schemas to help with working memory and reducing cognitive load, including the most highly cited article of the 1990s: Sweller et al.'s (1998) theoretical article is an explanation of working memory and how it can be improved through the use of schemas to lower the cognitive load for those who are learning new tasks or skills. This article was cited an average of nearly 120 times per year.

Other articles that fell under this theme included Bandura's (1993) article that researched how an individual's perception of their own self-efficacy played a role in their cognitive development at various stages of development. Bandura noted that those with higher self-efficacy were faster to discontinue the use of ineffective strategies, and this happened from a very young age. Those who did this were able to perform better overall and to learn more. A study in the Netherlands (Paas, 1992) explored the effects of cognitive load and schemas on the ability of students to: (a) solve a problem from the beginning, (b) complete a problem that had already been partially worked, or (c) understand and check a problem that had already been completed. Paas concluded that creating frameworks or schemas aided in the acquisition of new skills by reducing the cognitive load placed on the students from those skills. This left more room in the working memory to make adjustments, transfer other useful pieces of information, and use the schema as a foundation to learn more.

Counseling Relationships

There were also three top cited articles that covered relationships and counseling in this decade. Sue (1992) primarily studied counseling and the education that goes into the preparation of counselors. The article advocated for greater inclusion of multicultural perspectives in these preparation programs. According to Sue, diverse perspectives are often not taught or even mentioned during the education of counselors, so professionals are not being adequately prepared to build relationships and help others after they graduate. There were also articles that discussed the relationship between counselor and client (Horvath & Symonds, 1991) as well as that of teacher and student (Birch & Ladd, 1997). Horvath (1991) did a meta-analysis on the relationship dynamic between the therapist and patient, specifically researching the interplay between the two. Along similar lines, Birch and Ladd (1997) explored student- and teacher-reported relationships. They specifically studied a student's feelings for school and their relationship with the teacher on three scales: warmth, dependency, and conflict. Wentzel (1998) also used student and teacher surveys to analyze a student's relationship between their school performance and their relationship with teachers, parents, and peers. In each case, they found that having a strong positive relationship with parents, peers, and teachers was important because these relationships impacted different behaviors in the student.

Knowledge

Knowledge was a minor theme since a few empirical studies focused on the acquisition of and different types of knowledge. Schommer (1990) built on Perry's (1968) different dimensions of knowledge. Perry built those dimensions of knowledge as a linear model, while Schommer structured a model that was built on each dimension increasing at its

own rate. Schraw and Dennison (1994) wrote an article on their attempts to validate their inventory on metacognition. Their initial intention was to test the eight processes that are components of knowledge and self-regulation. Those eight components were very similar to those mentioned by Schommer (1990) earlier in the decade. Both articles reviewed the different types of knowledge that could be obtained and how such knowledge could be structured, controlled, and made accessible to students. In the case of Schraw and Dennison (1994), the study validated their Metacognitive Awareness Inventory and also included investigations into how certain strategies used by students were necessary to regulate that knowledge.

Other

There were only two articles that did not fit within any of the themes discussed above. Ames (1994) wrote a theoretical paper that discussed the perception of students in the classroom and the role that those perceptions played in their learning. Ames researched the perceptions of students regarding the structure of the classroom and encouraged teachers to move toward a mastery orientation to learning. This was the fourth-most cited article of the decade. The eighth-most cited article was a theoretical work by Wolf and Bowers (1999) in which they proposed a new concept, that of the double deficit, regarding reading dysfunctions in dyslexia.

2000s: Motivation, Cognitive Load, Problem-Based Learning, and Student Emotions and Counseling Psychology

The top two themes for the 2000s were student motivation and cognitive load. Other themes were student emotions in a school setting, problem-based learning, and counseling psychology. Motivation was the most prominent theme with six out of the top 20 articles addressing some aspect of student motivation, one of which is the most cited article of the decade. The two articles on student emotions are so closely connected to motivation that it is almost hard to distinguish them from the six discussing motivation. Nevertheless, because they attempt to focus on emotions over motivation exclusively, we have separated the themes for the purpose of this chapter.

Motivation

As mentioned in previous decades, the topic of motivation is a recurring theme through education psychology research. However, unique to this decade is that motivation was overwhelmingly the primary theme of the top 20 most cited articles.

The top cited article of the decade is called "Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions" (Ryan & Deci, 2000). This article has received 6,133 citations as of this writing. In this article, the authors described the current understanding of intrinsic and extrinsic motivation and the superior regard for intrinsic motivation that seemed to exist in the field. However, the authors argued, there are different types of extrinsic motivation, and it is not proper to lump all types of extrinsic motivation together. The best types of extrinsic motivation were those where the learner identified with the subject and endorsed its importance and those where the learner integrated the topic with his or her other knowledge. When students grasped the meaning and importance of a topic they were much more likely to identify with it and integrate it into their own knowledge. Learning is much more effective when it supports the needs of students to (a) feel connected to others, (b) feel competent, and (c) determine their course of action.

In the same year Ryan and Deci's (2000) article was published, Wigfield (2000) published a top cited article about the expectancy-value theory of motivation. This theory purported that students made decisions based on the expected potential rewards that could result from the decision. The article defined the important components of this theory's model and compared those components to the concepts of self-efficacy, intrinsic and extrinsic motivation, and interest. The author also reviewed longitudinal studies about how children value different activities over time, concluding that over time, children's views and beliefs generally declined from a more optimistic belief in their earlier years.

Hidi and Renninger (2006) later introduced a process by which interest is generated in a topic. The authors argued that interest started with triggered situational interest and then became maintained situational interest. After maintained

situational interest, individual interest could emerge and then potentially turn into a well-developed individual interest.

The other three articles discussed other topics related to motivation. The 15th-most cited article reviewed the motivational research regarding seven important questions related to motivation and education (Pintrich, 2003). The following year, Pintrich (2004) published another often-cited article that introduced a new way of understanding motivation. Their model was based on qualitative interviews with students rather than top-down theories. The model focused on a self-regulatory perspective rather than a student approach to learning perspective. The 19th-most cited article was published in 2000, reviewing and reinforcing the concept of self-efficacy (Zimmerman, 2000).

Cognitive Load

The second-largest theme of the 2000s is cognitive load. Three articles focused on different components of cognitive load. The major subthemes were (a) ways to reduce cognitive load and (b) the importance and potential of measuring cognitive load to advance the theory. All three of the articles came from the same volume of the same journal in 2003, a special issue focusing solely on cognitive load (Mayer & Moreno, 2003; Paas et al., 2003a, 2003b). The 20th-most cited article (Paas et al., 2003) was, in fact, an introduction to this journal volume, summarizing the developments of cognitive load to date and the topics addressed in that journal volume.

The eighth-most cited article, “Nine Ways to Reduce Cognitive Load in Multimedia Learning” (Mayer & Moreno, 2003), was a straightforward article that addressed the challenge of cognitive load and strategies for its reduction. The strategies were based on the foundational components of cognitive load (i.e., that our brains have two separate channels for processing multimedia content—hearing and sight—and that each channel has limited bandwidth for new information).

An additional article pointed to the need for measurements of cognitive load (Paas et al., 2003). The authors posited that if cognitive load was going to continue as a valid theory, then effective measurement strategies were needed. Without this, the theory of cognitive load would not be able to establish an empirical basis.

Problem-Based Learning

Problem-based learning was focused on in three of the top 20 articles. Two of the articles represented opposite sides of a debate about minimal guidance instruction and its effectiveness (Hmelo-Silver et al., 2004; Kirschner et al., 2006). In the second-most cited article of the decade, “Why Minimal Guidance During Instruction Does Not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-Based, Experiential, and Inquiry-Based Teaching” (Kirschner et al., 2006), the authors conducted a study that combined problem-based learning with minimal guidance instruction and stated that the evidence showed that minimal guidance instruction did not work. The 13th-most cited article was a response to this and argued that problem-based learning should not be categorized as minimal guidance instruction due to the amount of scaffolding present (Hmelo-Silver et al., 2007). The authors then presented evidence that problem-based learning was a very effective method of achieving learning outcomes as well as helping students develop other important skills along the way.

The fifth-most cited article was a literature review covering the current knowledge and understanding of problem-based learning as of 2003 (Hmelo-Silver et al., 2004). The authors outlined how problem-based learning had potential to develop students’ abilities to (a) gain knowledge that is flexible, (b) develop self-directed learning skills, (c) improve their abilities in problem-solving, (d) become intrinsically motivated, and (e) improve students’ skills in collaboration. The first three abilities had been demonstrated in research, while the latter two were lacking in support.

Student Emotions and Counseling Psychology

The other two ancillary themes of the decade were student emotions and topics related to counseling psychology. For student emotions, the articles focused on summarizing fragmented research about student emotions and creating a taxonomy of emotions that were experienced by students in an academic setting (Pekrun, 2006; Pekrun et al., 2002). Both articles pointed to the need for further research in this area in order for it to develop into a robust field of study.

The two articles regarding counseling psychology research both focused on research constructs. One focused on the difference between moderator and mediator effects, while the other focused on how to discern quality and trustworthiness of qualitative studies in counseling psychology (Frazier et al., 2004; Morrow, 2005).

Other

There were four articles in the top 20 that did not fit into any of the aforementioned themes. One of the articles developed a more robust method for assessing the extent to which a person has meaning and purpose in their life (Steger et al., 2006). Other topics addressed were consensual qualitative research (Hill et al., 2005), teacher burnout and work engagement (Hakanen et al., 2006), and spatial ability within Science, Technology, Engineering, and Mathematics (STEM) subjects (Wai et al., 2009).

2010s: Student Learning Outcomes, Best Statistical Practices, Instructional Technology, Teachers, and Cognitive Load Theory

A few novel themes emerged from 2010–2019, including student learning outcomes, best statistical practices, and instructional technology. However, teachers re-emerged as a dominant theme, continuing the trend from the 1990s and 2000s, and cognitive load theory remained a prominent topic in the literature. Only one of the most highly cited articles of the decade did not seem to fit into any of the main topics mentioned above. This article reviewed the gender gap in STEM fields. Wang and Degol (2017) summarized the most recent research associated with six possible explanations for this gender gap: (a) cognitive ability, (b) relative cognitive strength, (c) occupational interests or preferences, (d) lifestyle values or work–family balance preferences, (e) field-specific ability beliefs, and (f) gender related stereotypes and biases. The authors also discussed implications for practice and future research directions.

Student Learning Outcomes

Of the 20 most cited articles of the 2010–2019 time period, nine articles focused on student outcomes as the dependent variable. Six of these articles focused solely on student learning outcomes; however, three articles looked beyond learning outcomes and also included behavioral, psychological, or social outcomes. Throughout these articles, student learning outcomes were primarily discussed in terms of academic achievement and measured using a student's grade point average.

Notably, the independent variables in nearly all of these articles were contextual or external to the student. In other words, researchers during this decade were focused on improving student outcomes, but they approached this with the acknowledgment that many factors contributing to or limiting student success were outside of the students' control. The main purpose of these studies was to better understand the nature of the relationships between student learning outcomes and these external variables. While the majority of authors tentatively discussed implications for practice at the end of their articles, no specific or intentional interventions were being studied or proposed. The contextual or external factors studied as independent variables during this decade included the following: teacher support and structure (Jang et al., 2010), instructional methods (Alfieri, 2011), engagement strategies (Pekrun, 2011), classroom emotional climate (Reyes et al., 2012), school climate (Wang & Degol, 2016), and teacher competence (Kunter et al., 2013).

The only student-specific independent variables studied in relation to student outcomes were student engagement (Chi & Wylie, 2014), student executive function (Best et al., 2010), and student mindset (Yeager & Dweck, 2012). However, even when studying factors that are arguably in students' control, the focus of the research was on implications for teaching and instruction. For example, in the third-most cited article of the decade, Chi and Wylie (2014) introduced a new student engagement framework that delineated four different modes of student engagement, ranging from most impactful to least impactful on student learning. While these forms of engagement were measured based on student behavior, the focus of the study was not on what students could do to become more engaged; rather, the researchers

were primarily concerned with instructional strategies teachers could employ to elicit the highest levels of student engagement behaviors—namely, dialoguing and constructing.

Another example of this comes from the fourth-most cited article of the decade on student mindset and resilience. Here, Yeager and Dweck (2012) introduced the idea that what students believe about their (and others') intellectual abilities and social attributes impacted their achievement, stress, and aggression in certain settings. Again, the bulk of discussion about the implications for these findings surrounded the idea that educators and parents can shape student mindsets—for better or for worse. Unlike other articles from this decade, Yeager and Dweck (2012) did discuss specific implicit theory intervention practices that were appropriate for helping students develop healthy mindsets. Taken together, the literature during this decade gave us additional considerations and insights into how to support student learning outcomes.

Statistical Processes

Missing Data

The second- and tenth-most cited articles of the decade were published in 2010 and addressed the same topic: missing data practices. One was published in the *Journal of Counseling Psychology* and the other in the *Journal of School Psychology*. The article written by Schlomer et al. (2010) established this as an issue worth addressing in the field when they reported that only 14 of 37 quantitative studies in the most recent volume of *Journal of Counseling Psychology* reported any missing data at all. Of those, 11 used deletion as their method of handling missing data.

According to the authors in both studies, deletion methods, as well as single imputation and mean substitution methods, were “poor” (Schlomer et al., 2010, p. 6) and “archaic” (Baraldi & Enders, 2010, p. 33). Subsequently, both sets of authors called on school and counseling psychology researchers to replace these methods with the most up-to-date, “state of the art” approaches recommended by the American Psychological Association (APA): maximum likelihood and multiple imputation. Schlomer et al. (2010) extended an additional call to editors, imploring them to heighten their standard of missing data reporting and to “insist that missing data be attended to in quantitative articles” (Schlomer et al., 2010). While both articles discussed the advantages of maximum likelihood and multiple imputation in detail, Baraldi and Enders (2010) also provided two analysis examples for reference. These examples can be particularly helpful for researchers who have not been exposed to the newer methods of handling missing data.

Multilevel Modeling

Another best statistical practices article similarly called on school and counseling psychology researchers to become familiar with the multilevel modeling methodological approach. This article, “A Practical Guide to Multilevel Modeling” (Peugh, 2010), was intended to assist researchers in learning and applying this methodology to their work. To do so, Peugh provided a detailed, seven-step process for conducting multilevel modeling and walked through two examples.

Overall, these three articles represented a trend toward more sophisticated and regulated methods of statistical analysis and research in the field.

Instructional Technology

Three top articles of the decade reviewed and discussed innovative instructional technologies: computer tutoring, serious games, and immersive virtual reality. The computer tutoring and serious games articles were meta-analyses, whereas the immersive virtual reality article was an empirical study. All three articles discussed these technologies in comparison to traditional instructional methods.

Regarding computer tutoring, VanLehn (2011) challenged the longstanding belief that human tutoring is, in all cases, superior to computer tutoring. The meta-analysis found that when tutoring is considered based on the granularity of knowledge, rather than the mode of tutoring, human tutoring reached a plateau; at that point, certain types of computer tutoring have the potential to be superior (VanLehn, 2011). As these meta-analysis findings contradicted previous studies, further research on the topic was recommended.

The serious games meta-analysis, which was the most cited article of the decade, was concerned with the cognitive and motivational effects of serious games compared to conventional instructional methods. Wouters et al. (2013) analyzed 38 articles on serious games published from 1990–2012. Seven hypotheses were tested. Four of the seven hypotheses were confirmed, indicating that serious games yielded higher learning gains and a higher level of retention than other conventional instruction methods. These higher learning gains were further strengthened when serious games were combined with other methods of instruction and when multiple training sessions for serious games were employed. Hypotheses that were not confirmed led to three conclusions. First, serious games were not more motivating than other instructional methods. Second, students did not learn more when engaging in serious games by themselves; rather, students learned more when engaging in serious games in groups. And, finally, learning gains between serious games and passive instruction were not higher than learning gains between serious games and active instruction.

Finally, Parong and Meyer (2018) compared immersive virtual reality with PowerPoint slideshow instruction. They found immersive virtual reality to be more motivating for students than the conventional PowerPoint instruction but not more effective for teaching. While the authors acknowledged that these findings may indicate that “the conversion of multimedia lessons into virtual reality may not yet be warranted” (Parong & Meyer, 2018, p. 785), they discussed the importance of motivation on learning and recommended further research on the topic.

This research showed strides being made toward a better understanding of the use of various technologies in education. However, in all cases, further research was recommended. Thus it can be concluded that instructional technologies is an area of research that could benefit from additional study and understanding.

Teachers

Six articles had a heavy emphasis on teachers. The majority of these articles were referenced previously in the Student Learning Outcomes section, as researchers seemed primarily concerned with how teacher practices or instructional methods impacted students (Alfieri et al., 2011; Kunter et al., 2013; Reyes et al., 2012). However, there were two articles about teachers where student learning outcomes were not the main focus.

One review article specifically addressed research on teacher scaffolding over the last decade. Van de Pol et al. (2010) agreed that the research shows scaffolding to be effective, but they stated that “the measurement and analysis of scaffolding appears to be in its infancy” (p. 287). Next steps for this area of study were to find an agreed-upon definition and measurement instrument for scaffolding. Another article from this decade researched relationships between teacher self-efficacy, job satisfaction, teacher gender, years of experience, and job stress. While this was the only top cited article from the decade that was strictly teacher-focused, several key insights regarding work-related stress, job satisfaction, and self-efficacy can be gained from Klassen and Chiu’s (2010) findings. For instance, this study found that female teachers had higher levels of work-related stress. Overall, work-related stress negatively impacted job satisfaction. Also related to job satisfaction was teachers’ self-efficacy. Specifically, “teachers’ self-efficacy for instructional strategies and classroom management positively [influenced] job satisfaction” (Klassen & Chiu, 2010, p. 747).

Cognitive Load

Two articles surrounded the topic of cognitive load theory—one theoretical piece published at the beginning of the decade and one literature review article published at the end of the decade. Sweller, an Australian educational psychologist, was the lead author of both. In the 2010 article, he added nuance to cognitive load theory when he suggested that element interactivity underlies not only intrinsic cognitive load but extraneous cognitive load as well.

Sweller et al.’s (2019) review article discussed this theoretical work, as well as many other theoretical pieces written from 1998–2018 on cognitive load theory. Furthermore, Sweller et al. comprehensively summarized the empirical research on the topic of cognitive load theory and presented possible directions for future research, although it was ultimately recommended that we “not try to predict the future but create it by continuing to do good research” (Sweller, 2019, p. 288).

2020 and Beyond: Self-Efficacy, Student Learning, Cognitive Load, and Motivation

Moving forward into the next decade, four themes continue to emerge: self-efficacy, student learning, cognitive load, and motivation. Self-efficacy was grouped together with similar topics such as self-regulation and self-determination. Several articles published in 2020 discussed how students learn and what can be done to help students to learn more effectively. Cognitive load was grouped with other topics such as working memory and seductive details theory. Motivation was a theme unto itself as researchers typically use this exact term along with other words to distinguish their meaning, such as intrinsic or extrinsic. Three other articles, including one about the effects of the COVID-19 pandemic were the last of the articles in the top 20 of 2020.

Self-Efficacy

Seven of the top 20 articles explored or explained self-efficacy or self-regulation. These included various types of articles that explored how students gained a better understanding of their own understanding and how that may impact student learning and learning strategies. Vasconcellows et al. (2020) was the most cited article of the year and dealt specifically with self-determination when it comes to physical education. Ryan and Deci (2020) explored intrinsic and extrinsic motivation from a self-determination perspective, examining their definitions and what new perspectives may arise through a self-determination theory lens. An article that fit into a few of these themes was Nückles et al.'s (2020) study, which researched how journal writing helped students learn to self-regulate and work with cognitive load. Bardach et al. (2020) conducted a meta-analysis examining achievement goal theory, looking for evidence that achievement goal theory is accurate. Kim and Burić (2020) researched the relationship between teacher burnout and the teachers' sense of self-efficacy. Van Gog et al. (2020) examined the role of mental effort while students were learning to solve problems using self-regulation strategies. De Bruin et al. (2020) created the Effort Management and Regulation Framework synthesizing cognitive load and self-regulation theory to point out an area they believe is being ignored, asking questions such as how students monitor effort.

Student Learning

Student learning covers a variety of specific topics in these articles that explore how educators can more effectively teach students. Sailer and Hommer (2020) conducted a meta-analysis on the gamification of learning. Nückles et al. (2020) explored how journal writing could help with cognitive load. Tenenbaum et al. (2020) did a meta-analysis studying the effectiveness of peer interaction in learning. Bernacki et al. (2020) examined how the use of mobile technology has changed the learning process as well as how the role of technology in education is being better understood and measured. And Bowers (2020) argued that the use of systemic phonics in reading may not be more effective than alternative methodologies. These all centered around the theme of questioning how students learn, whether it is questioning traditional practice or in considering non-traditional benefits for current practices.

Cognitive Load

Cognitive load, combined with schemas and working memory, continued to be a strong trend. As mentioned above, Nückles et al. (2020) studied journal writing as a way to help students learn self-regulation skills, particularly regarding cognitive load. Related to working memory, Sundararajan and Adesope (2020) conducted a meta-analysis on the seductive details theory, which describes and quantifies the effect of tangential details that, while nice, act as distractors from the purpose of the material. By adding in these tangential details, students are being seduced into trying to remember more than they are capable of and may lose important information. De Bruin et al. (2020), as mentioned above in the section on motivation, created a framework that pointed out how cognitive load is related to self-regulation and identified research that should be done to further explore how students use self-regulation strategies to manage their cognitive load.

Motivation

Two articles continued the trend of researching motivation: Eccles and Wigfield (2020) and Schunk and DiBenedetto (2020). Eccles and Wigfield (2020) considered expectancy-value theory from a variety of perspectives (e.g., developmental and sociocultural) to see how these perspectives would make a difference when researching situated expectancy-value theory. Schunk and DiBenedetto (2020) discussed how motivation can be understood through Social Cognitive Theory and motivation, analyzing the processes that influence goals and self-evaluations of progress.

Other

When considering trends moving into the future, there were a few articles from the top 20 that did not seem to fit into a particular theme with some of the other articles. Conoley et al. (2020) wrote a review researching how school psychology was performing and how it was lacking. Sinatra and Lombardi (2020) discussed how evaluating sources for scientific data may need to adjust. O'Brien et al. (2020) examined challenges minorities face and the degree to which the culture of ecology and evolutionary biology are inclusive.

Only one article on the coronavirus and the ensuing pandemic was included in this grouping. Kim and Asbury (2020) wrote about the impact on teachers after six weeks of being in lockdown because of the pandemic. It is expected that this will continue to be a popular theme in the short term since many teachers, students, and families tried online learning for the first time during the pandemic.

Looking to the future, there are a few trends from the last 50 years that will most likely continue to be studied. Self-efficacy and self-regulation have been major themes throughout the last 50 years, and they were well represented in 2020. Cognition, motivation, and student learning were other trends that have been closely examined during the last 50 years and continued to be well represented as the field moves into the 2020s.

Synthesis of 50 Years: Common Themes Throughout the Decades

Since the 1970s, motivation, self-efficacy, and self-regulation continue to be common areas of interest in the field of educational psychology. The literature also frequently touches on schemas and cognitive load. Significant numbers of new measurement tools and standards were also developed and advanced. Repeatedly, educational psychology studies outlined the factors affecting learning and counseling, observed and organized insightful findings, and suggested how this cognizance could lead to improvements for students, teachers, counselors, and clients alike. Because of this, articles and studies throughout the past five decades were centered around determining the effects of external and internal factors on both learning and counseling outcomes. The subject consistently comprised teachers, students, counselors, or clients. With all of this in mind, we delve into more detail regarding common themes.

Teachers

In the 1970s, researchers began to study teachers and the effect that they had on the learning process. A major article described the impact of teachers on the classroom experience. Brophy (1979) discussed how the behaviors of teachers are very influential on their students. In the 1990s, there was a continuation of this research on the relationship between the effect of the teacher in two studies. The first (Birch & Ladd, 1997) explored the relationship of the teacher and student for children who were just entering school based on three scales: closeness, dependency, and conflict. Through these three characteristics, it was determined how well the students were adjusting to school. The other (Wentzel, 1998), explored which relationships (student–peer, student–parent, or student–teacher) affected different types of motivation (e.g., social, academic).

In the 1980s, Gibson and Dembo (1984) studied the behavior of teachers in relation to their self-efficacy. The 2010s saw a focus on instructional strategies teachers could use to promote student engagement (Chi & Wylie, 2014). Van de Pol et al. (2010) discussed how scaffolding could be a very effective tool for teachers to use, though scaffolding will need

to be more clearly defined in the future. Klassen and Chiu (2010) studied how teacher self-efficacy, job satisfaction, teacher gender, years of experience, and job stress were related. This was followed up by Kim and Burić (2020) who studied the directionality of the relationship between teacher self-efficacy and teacher burnout.

Self-Concept, Self-Efficacy, and Self-Regulation

The topics of self-concept, self-efficacy, and self-regulation were present throughout multiple decades. Beginning in the 1980s, one author in particular, Marsh, published numerous articles setting the framework for the idea of self-concept. In his popular 1985 study with Shavelson, Marsh worked to break down the different areas of self-concept. This allowed him to later build on this research with other authors, such as Parker (1987), and investigate conjecture such as the big-fish-little-pond effect, as well as the hypothesized ways in which self-concept might form and impact an individual.

In many ways, the idea of self-concept transitioned into the idea of self-efficacy. Self-efficacy appeared in the 1980s, when Betz and Hackett (1981) applied Bandura's self-efficacy theory to the career decision-making process. It was also used when Salomon (1984) employed it as a basis for determining the combined effects of self-efficacy and amount of invested mental effort on subsequent achievement. Self-efficacy was also used as a measure in Zimmerman's (1989) study on self-regulation in K–12 students. In the '90s, Bandura (1993) formally defined self-efficacy, and this played a role in multiple articles with various authors throughout the '90s. In the 2000s, the concept of self-efficacy was referenced in multiple popular articles. Teachers' self-efficacy in relation to their effectiveness in the classroom became more apparent in the 2010s and 2020.

Self-regulation was commonly tied to both self-concept and self-efficacy. In the late '80s Zimmerman (1989) utilized variables such as self-efficacy to further understand self-regulation in K–12 students. And, in the '90s, Pintrich and de Groot (1990) considered the fundamental makeup of self-regulation. Skipping ahead to 2020, a number of popular articles exist regarding self-regulation, and self-regulation began to intertwine with other popular topics, such as cognitive load. For example, Nückles et al.'s (2020) article on student journal writing and the effect on self-regulation and cognitive load. Additionally, we saw self-regulation evolving into the concept of self-determination. Or, according to Wehmeyer et al. (2017), an evolution from self-regulation's "focus on goal-directed actions" (p. 232) to self-determination's focus on "perceived internal vs. external loci of causality" (p. 232). For example, Vasconcellos et al.'s (2020) article centers on self-determination, rather than self-regulation, in relation to physical education.

Motivation

The topic of motivation may have been the most discussed theme throughout the 50 years covered in this chapter. What motivates students and how to get students more motivated to learn seem to be the predominant questions asked throughout these decades. In the '70s, the questions were general, focusing on how effort plays into motivation and how students think about their previous successes or failures. In the '80s, the focus shifted to goals and what types of goals lead to the best learning outcomes. Mastery-oriented goals stood out from the research as the best type of goals to encourage in the classroom. The '90s started to evaluate how students approach motivation and how it is created within a classroom. The 2000s expanded upon this, delving into the details of intrinsic versus extrinsic motivation and parsing out the different types of extrinsic motivation. Eventually, the discussions on motivation have become much more specific, analyzing the way motivation works within specific contexts.

Cognitive Load

The theme of cognitive load spanned multiple decades. Beginning in the '80s, Meece et al. (1988) began to think about cognitive processing via their study analyzing students' cognitive engagement. In the '90s, Sweller et al.'s (1998) theoretical article explaining various aspects of the working memory opened up the concept for future decades. In the 2000s, popular studies focused on methods of measuring and reducing cognitive load. Multiple authors contributed to this theme by way of various articles during the 2000s. The 2010s also saw authors building on existing cognitive load theory. Sweller (2010) split the concept into both intrinsic and extraneous cognitive load. Additionally, at the close of the decade, Sweller summarized existing research regarding cognitive load. Finally, in the 2020s, a handful of popularly cited articles regarding cognitive load emerged. Nückles et al. (2020) studied the correlation between student

journaling, self-regulation, and cognitive load. De Bruin et al. (2020) constructed a framework consisting of elements of both self-regulation and cognitive load theories. De Bruin et al. (2020) also explained student-driven efforts to self-regulate cognitive load.

Measurement Tools and Statistical Processes

Advanced measurement tools and statistical processes were introduced and discussed in several of the top cited articles over the last 50 years. This started in the 1970s with the introduction of the Mathematics Anxiety Scale (Betz, 1978). Three other highly cited measurement tools that developed over the last 50 years included the binomial effect size display (BESD; Rosenthal & Rubin, 1982), the Working Alliance Inventory (WAI; Horvath & Greenberg, 1989), and the Metacognitive Awareness Inventory (MAI; Schraw & Dennison, 1994). Despite this progress, there are still areas of educational psychology and counseling research where the development of measurement tools is needed. For instance, in their meta-analysis Van de Pol et al. (2010) recommended a measurement tool for scaffolding be developed.

In addition to new measurement tools, advanced statistical processes have been discussed in the literature. Factor analysis technique (Tinsley & Tinsley, 1987) and multilevel modeling (Peugh, 2010) are two statistical techniques that educational psychology and counseling researchers have discussed in the literature and encouraged others to use. Additional attempts to advance the statistical rigor of research came from Schlomer et al. (2010) and Baraldi and Enders (2010) when they discussed best statistical practices regarding missing data.

Most Important Issues, Topics, and Trends by Decade

Throughout the period, writings on educational psychology and counseling led to the emergence of topics and trends that seemed to define each decade. Additionally, once an idea was established in any given decade, the material and literature could then go on to serve as a building block or reference point for future decades. Problems and concerns that spanned multiple decades, such as cognitive load and how to motivate, became somewhat of a backbone for the overall literature of this field.

In the '70s, schema theory was a novel idea introduced to the discipline. Schema theory focused on the learning of new materials and how those new materials become incorporated into existing understanding. Wittrock (1974) proposed that previous preconstructed knowledge of a subject contributes to newly generated understanding in learners. Pichert and Anderson (1977) showed that the preexisting perspective of a learner influenced the ideas that they subsequently recollected. Additionally, Pichert and Anderson (1977) also found that the perspective of an individual student contributed to setting the level of importance.

The '80s brought about important insights into self-efficacy and self-regulation, beginning with Betz and Hackett's (1981) investigation into Bandura's self-efficacy theory and the authors' efforts to apply the theory to the process of deciding on a career. In 1984, Salomon analyzed the achievement levels associated with television versus print media using the idea of self-efficacy. Zimmerman's (1989) study five years later involved determining the effects of self-efficacy, among other factors, in students' self-regulation. In the same year, Grolnick (1989) discussed the role of parents in a student's self-regulation capabilities.

The '90s placed a spotlight on cognitive load that would carry on in future decades. Sweller et al. (1998), in the most highly cited article of the decade, explained working memory and built on the idea of using schemas to decrease the necessary amount of cognitive load for learning purposes. Paas (1992) paired the ideas of cognitive load and schemas to observe the problem-solving abilities of students at various levels of a problem's completion (i.e., not at all complete, partially worked, or completed).

In the 2000s, the common theme of motivation exploded in popularity. As the most cited article of the decade, "Intrinsic and Extrinsic Motivations: Classic Definitions and New Directions" aimed to more deeply explore the two types of motivation (Ryan & Deci, 2000). Also high on the list was Wigfield's (2000) study on the intrinsic and extrinsic decision-making process in relation to a student's expected rewards. Hidi and Renninger (2006) analyzed the development of

interest in a topic and how it then transforms into a motivating factor for continuing interest. A handful of other articles in the 2000s rounded out the decade's impact on the area of motivation.

In the 2010s, articles regarding student learning outcomes dominated the list of top cited articles. Authors in this decade researched whether the factors affecting learning outcomes were contextual or external to the student. The majority focused on student learning outcomes in relation to external variables. Some factors considered were teacher support and structure (Jang et al., 2010), instructional methods (Alfieri, 2011), engagement strategies (Pekrun, 2011), classroom emotional climate (Reyes et al., 2012), school climate (Wang & Degol, 2016), and teacher competence (Kunter et al., 2013). Student-specific areas studied were student engagement (Chi & Wylie, 2014), student executive function (Best et al., 2010), and student mindset (Yeager & Dweck, 2012).

As outlined in this synthesis, multiple common themes and trends emerged over the past 50 years in the field of educational psychology and counseling. The general literature has evolved the concept of students, teachers, counselors, and clients in relation to a variety of factors and has focused on improving the outcome as defined by multiple variables. We are interested to observe how the effects of the unprecedented 2020 pandemic work to shift the literature in decades to come.

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Higher Education

A History of Research Trends from 1970 to 2020

Melissa Franklin, Johanna Chan, Krista Gardner, Erin Measom, Bobbie Sandberg, Julie Irvine, & Royce Kimmons

Education

Higher Education

Education Research

Impact

Research

Research within the field of higher education has rapidly expanded over the past 50 years. The purpose of this study was to synthesize the research of higher education from 1970 through 2020 and identify the trends and themes in that time period. While many authors have surveyed higher education research by studying all publications (output), we reviewed the field by focusing on the publications that made the biggest impact through the number of citations (outcome). We used a bibliometric literature analysis to identify the 20 most highly cited journal articles of each decade and then measured the number of citations. This comparison of citation counts allowed us to trace the growth and changes in topics of the most interest to higher education researchers and determine which themes had the most impact on the field. Themes centering on students and learning—such as effective teaching, retention, engagement, assessment, feedback, and employability—were the most common among the high-impact articles. Our findings suggest that over time, the field of higher education has moved away from a teacher-centered approach and more towards a student-centered focus in order to encourage deep, applied learning. The results of our analysis also showed that many of the identified trends are connected to the social, political, and economic influences of the same time periods, including an increasingly diverse and growing student population and a transformation in education delivery methods.

Higher education has changed dramatically in the last 50 years. The casual observer may point out the increasingly diverse and growing student population despite rising tuition costs or the transformations in education delivery methods due to worldwide technological advances. They might have even noticed an expansion of the possible areas of study. In our analysis of the last 50 years in higher education, we also observed these same changes and other developments not so easily identified by the casual observer.

Just before the 1970s, the Higher Education Act was introduced in the United States, which made education more accessible for lower-income individuals, while simultaneously encouraging growth at smaller colleges. In this same period, during the Vietnam War (1955–1975), college enrollment increased 4–6% in young men (Card & Lemieux, 2001). The end of the war brought a shift in educational progress, evidenced by the rapid growth of higher education research, and the beginning of a quantitative leap in research (Marton & Svensson, 1979).

In the last 50 years, publications on the topic of higher education have grown rapidly. In our analysis of major journals from the field, we found the 883 articles that were published on the topic in the 1970s grew to more than 10,000 articles in the 2010s and more than 2,000 articles in the year 2020 alone (see Figures 1 and 2). This reflects the enormous growth of higher education institutions and researchers around the world (To & Yu, 2020). A variety of reasons have been identified for this exponential growth, but one likely reason is funding. As early as 1985, having noted that higher education research had already begun its dramatic rise, (see Figure 2) Altbach (1985) wrote,

In recent years, funds have become available for higher education research and a variety of institutions have sponsored research. . . . Agencies have been concerned with specific policy-related questions, and researchers have, in general, responded to the questions posed by funding sources and government agencies. Thus, the scope, sophistication, and coverage of the research [have] increased dramatically.

Figure 1

Number of Articles Published by Year

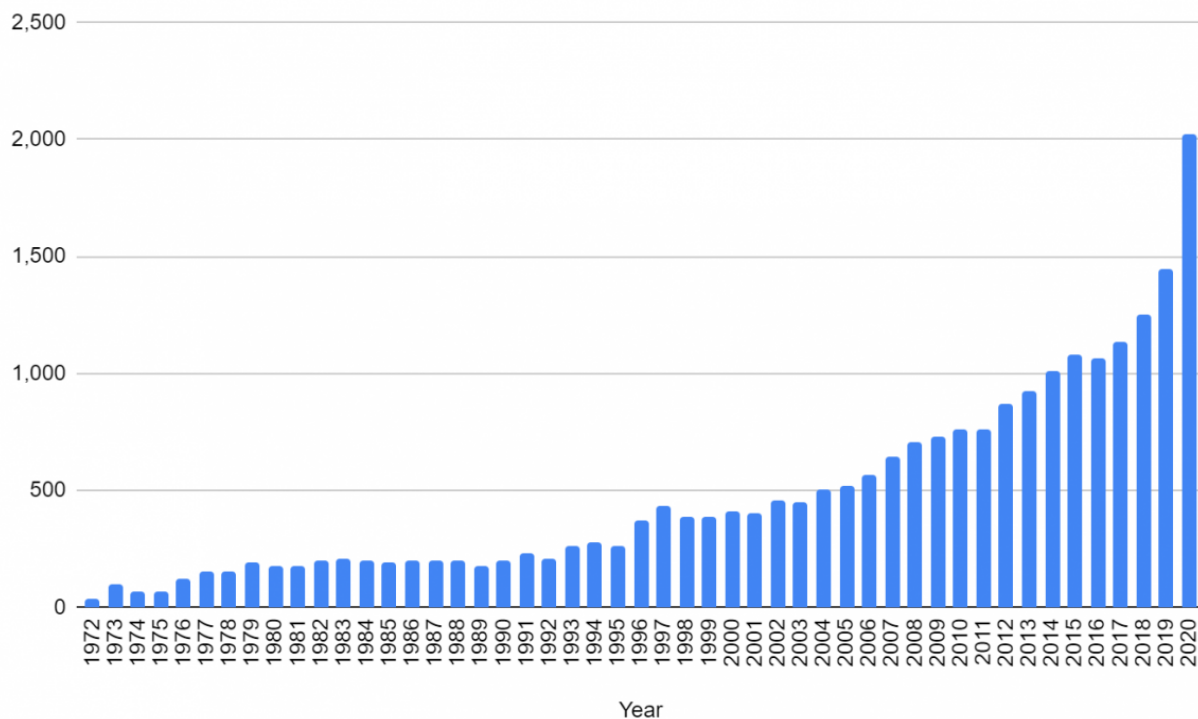
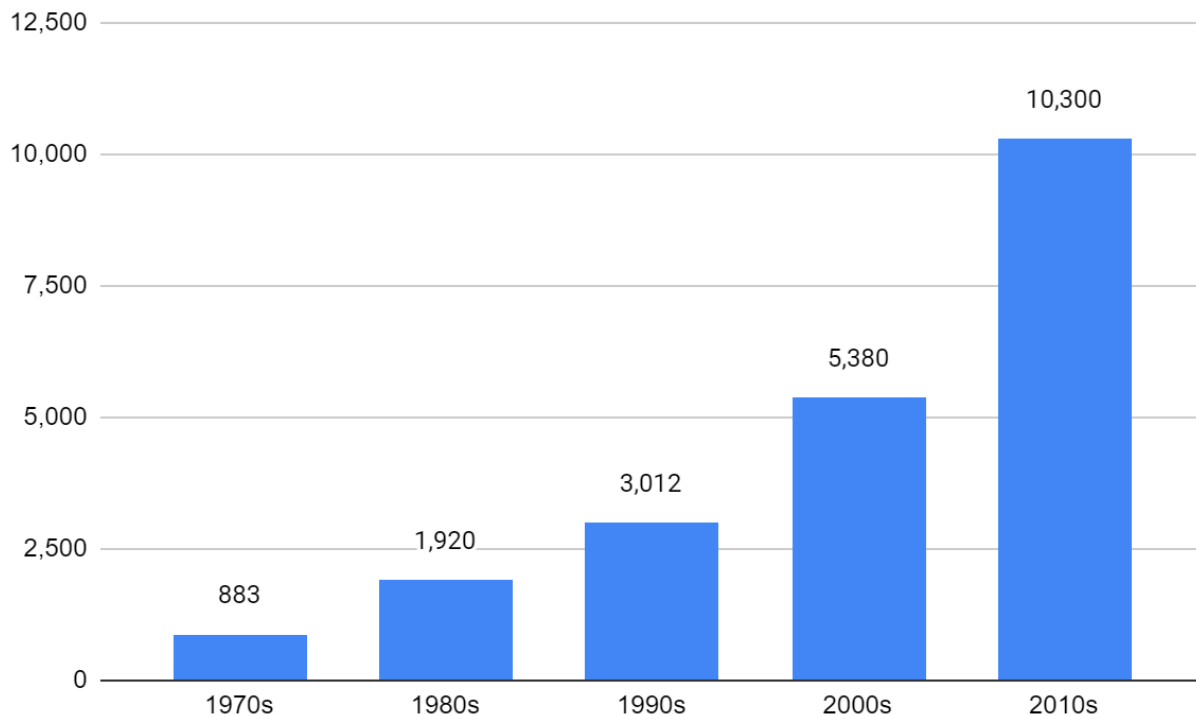


Figure 2

Number of Articles Published by Decade



Since 1985, other influences and reasons for the increase of publications have been identified, including the large number of researchers working and publishing in all fields of higher education. To and Yu (2020) recently recorded a three-fold rise in the number of active higher education level researchers since the 1980s from 4 million in 1980 to 13.1 million in 2018. They also registered a four-fold increase in publications, from 0.65 million in 1980 to 3.16 million in 2018 (To & Yu, 2020). While the dramatic increase represents researchers and research interests across an array of fields, the numbers also explain the drastic increase in publications focused on the area of higher education.

Understanding trends in the field of higher education as a whole has become increasingly difficult due to the large number of articles published in the past 50 years. Several researchers have previously attempted to understand common themes and patterns using both different topics and methods of analysis. Trow (1972) used the topic of analysis approach, and his research focused on access to education. Using a method of analysis, both Altbach (1985) and Budd (1988) completed literature reviews. Altbach's literature review centered on a topical analysis and Budd's research tracked authors with repeated citations. Other methods of analysis included Teichler's (1996) and Frackman's (1997) attempts to organize the growing amount of research in the field of higher education into categories and major themes, which divided the research into specific areas that could then be analyzed more closely.

These thematic studies as well as topically focused bibliometric studies (see Appendix) have contributed to the discussions on broad themes and trends within higher education research. Tight, a prominent higher education researcher, has completed extensive research in order to organize higher education research themes into eight categories (2020c). To build on this comprehensive research, we have not only identified emergent themes from the last 50 years, but we have also attempted to show the impact specific publications have had on broader thematic discussions by comparing the themes addressed by the most cited articles with Tight's eight themes. Citation counts indicate the popularity of an article within its decade and indicate topical priorities among the larger body of literature.

Higher Education Research Themes (Tight, 2020)

1. Teaching & Learning
2. Course Design:
 - a. Types of Instruction
 - b. Types of Learning
 - c. Distance, Online and Elearning
 - d. Curriculum
 - e. Assessment
 - f. Outcomes
3. The Student Experience
4. Quality
5. System Policy
6. Institutional Management
7. Academic Work
8. Knowledge & Research

We analyzed 20 journals with the most influence in the subdiscipline of higher education research (see “Methodology” chapter) to identify articles with the most citations per decade and also per year. We examined the 20 top cited articles of each decade, which were pulled from 15 of the original 20 journals of influence. (Refer to the Appendix for a complete list of journals and the number of cited articles.)

In the following sections, we have connected and grouped articles addressing common topics by decade. In the 1970s, researchers addressed learning environments, student ratings, study processes, and attrition. Attrition continued as a topic of interest in the 80s, along with instructor effectiveness and self-assessment. By the 1990s, topics were shifting towards student-centered learning, and we started to see newer perspectives influencing researchers’ topics, resulting in more top cited research in the areas of critical theory and postmodernism. In the 2000s, student-centered topics continued to be of interest; internationalization also became prominent, showing the growing globalization of higher education. Finally, the 2010s brought a focus on the employability of graduates from higher education institutions as well as continued interest in engaging students. In anticipation of the 2020s, a survey of the research from one year (2020) showed a growing interest in online learning as well as continued interest in employability and internationalization.

To conclude our research, we (a) compared impactful topics identified by citation count (output) with those identified by Tight (outcome), (b) traced the evolution of both the student experience and the role of instructors, (c) discussed the emergence of the internationalization of higher education, and (d) evaluated the changes in researchers’ perspectives as evidenced by increased publications in the areas of critical theory and postmodernism.

The 1970s: Learning Environment, Student Ratings, Study Processes, and Attrition

Multiple themes of research in higher education emerged when we analyzed the most popular articles written in the 1970s. The research examined student–professor relationships and student-centered learning environments. The research also emphasized students’ learning processes and student motivation. Less than half of the 20 most cited articles of the decade were empirical research, which was completed primarily with questionnaires and in-person interviews. Most of the articles were theoretical, pulling from previous studies to make conclusions.

Learning Environment

In the research of the 1970s, we saw an interest in learning methods and best teaching practices. This revealed an experiential focus, as understanding the experience of the learner became more important in helping the learner (Marton & Svensson, 1979). Experiential learning was not a new idea in the 1970s, but this was the decade that the phrase was coined and presented as a theory by Kolb in 1976 (Fry & Kolb, 1979). The focus on individual student experiences made it more difficult to translate theory and research into practice. However, Marton and Svensson made the point that learning and teaching is a “human act” that cannot just be prescribed (1979, p. 483).

When Ramsden (1979) asked students what helped them learn, the students responded with three aspects: when a teacher can (a) reach the students’ level through lecture, (b) create a warm environment for learning rather than an environment of fear, and (c) be humble as a teacher. The students’ responses reflected a careful balance between being too harsh and too lenient. To Ramsden, it seemed that a teacher’s attitude was an important factor in the learning environment.

Elton and Laurillard (1979) wrote that educational research in the past had been done using the same methods as the physical sciences (i.e., creating a hypothesis and testing it in a controlled environment). They found this to be less effective in the field of education, suggesting instead that researchers study students and teachers within their current environments. In their article, they mentioned that in place of a hypothesis, the purpose of a study could reveal itself as teachers and students are observed. They thought the focus of an educational research study should be more on the relationship between teacher and student, rather than on a particular event. Elton and Laurillard advocated for more research to be done in the natural environment of the classroom rather than the laboratory, with closer interaction between researcher, teacher, and student.

Students, as well as teachers, benefited from being more involved in research and the learning process. Students tended to be more involved in their learning and to seek deeper understanding if they took more active (rather than passive) roles in their learning (Dahlgren & Marton, 1978). Student-centered learning was implemented through peer teaching; it was enacted for social reasons—namely, greater support and relatability—and stemmed from an effort to encourage students to be more active in the learning process (Goldschmid & Goldschmid, 1976).

Depending on the field of study, the learning process differed. Various disciplines viewed learning differently; some disciplines were more focused on experiential learning, and some were more theoretical in their approach (Marton & Svensson, 1979). The applied sciences preferred formal education with a focus on lectures, graduation rates, and employability. In contrast, the social sciences had a much less formal learning environment with more interaction between students and teachers. However, Ramsden (1979) found that students in the social sciences were seen as less employable. In a further comparison of disciplines, Ramsden also found differences in levels of processing by students. Where students had weaknesses or less interest in a subject, there was shallower processing and less learning involved.

In a further discussion of students’ processing levels, Laurillard (1979) investigated what made students more likely to engage in deep-level processing versus surface-level processing. She noted that students using a surface-level processing method to complete a project were not necessarily lazy but were simply reacting to the particular learning situation. How well students processed material was related to the learning environment, not just the students as learners. For instance, students tended to spend more time on assignments that were crucial to their grades. If their learning environments promoted surface-level learning (e.g., regurgitating facts on a test), then students would likely use surface-level processing. In one popular article, researchers addressed processing depth by advocating for a qualitative approach to learning: lessening the materials quantitatively (reducing an overload of facts and information) for the sake of deeper understanding (Dahlgren & Marton, 1978).

Many students tended to take for granted the learning processes they used, while some were able to pull from their learning experiences and better able to analyze what made their learning successful (Säljö, 1979). Those who took their learning processes for granted often misperceived their learning as mere memorization of facts, but other students

became “cue conscious” as they became more aware of their learning environment and what might be important to their learning (i.e., classrooms where certain materials will be on a test). Being cue conscious meant they became aware of the implicit rules of a classroom and adapted their level of processing to meet the different demands of each learning environment (Säljö, 1979, p. 448). For example, a student was cue conscious if they recognized that their teacher expected them to prepare for multiple choice answers on a test rather than full sentence answers. Ramsden (1979) mentioned that these students had also been labeled “cue-seekers” in other studies (p. 414). As students started to understand learning, especially outside of the formal structure of school, they started to see learning as a process (which Säljö termed “thematized” learning), rather than a method to reach a goal (Säljö, 1979, p. 446). These learners started to gain deeper understanding of the material and made changes to their study habits. These changes influenced other significant research in the 1970s.

Study Processes

Approximately a quarter of the research in the 1970s sought to understand students' study methods and whether they were helpful in the retention of material. In the most cited study of the decade, Biggs (1979) researched possible effects on the quality and quantity of learning. In the study, students were either given instructions to focus on the facts or the purpose of the experiment they were reading. Students who were asked to retain facts were successful if they were already familiar with memorization as a type of learning. However, researchers found the quality of those students' learning to be less robust than if they had focused on understanding instead of rote memorization. Biggs demonstrated that students would adjust their study methods based on the quality of learning required of them, but their study methods were still affected by previous study habits.

The theme of study processes was also represented by the second-most cited publication of the decade; it was a theoretical analysis categorizing methods of study using the Lancaster Inventory. The Lancaster Inventory measured study methods and categorized them as “[a] deep level approach” or “intrinsic[ly] motivat[ed]” (Entwistle et al., 1979, p. 370). The researchers found three types of student study habits: (a) meaning, some students studied to find greater meaning; (b) reproduction, some students studied to follow the instructor's requirements exactly; and (c) achievement, some students studied to receive the grade or recognition they desired. Study processing research provided another way to understand students' experiences, providing methods to help students learn through observation of their environment. Study process methods are an ongoing area of interest; expanded research studies in this area frequently cite these foundational studies from the 1970s.

Student Ratings

Research on student ratings was also a popular research topic in the 1970s. Feldman wrote five of the 20 most cited articles of the decade, all focused on student ratings of teachers. With a recognition of the growing popularity of student ratings, Feldman (1977) sought to better understand their reliability, though it is possible his interest stemmed from curiosity about his own students' ratings.

Feldman (1979) found that students were likely to give higher ratings when they felt the consequences were higher (for example, if the professor would be evaluated for promotion based on the ratings). The amount of students who completed ratings also tended to go up when the ratings were completed anonymously or if the teacher was present during completion. In another article, Feldman (1978) studied student rating consistency, either between disciplines or over time and contexts. He found the factors that influenced ratings were larger class sizes, student motivations, course levels, course requirements, meeting times, and fields or materials studied. In a research review, Feldman (1976a) also found that students' grades were positively correlated to the ratings students left for their professors. Feldman was unable to find instructor bias as a factor in this correlation.

Feldman did not hold a monopoly on the topic of ratings. At least two other articles sought to understand how students felt about their learning experience and their teachers' effectiveness. Frey (1978) pointed out that most students were incapable of understanding and judging the scholarship and research that professors engage in; therefore, they could not be adequate judges of professors' teaching. Students often based their ratings on professors' teaching styles or

class rigor rather than on the material the professors taught. Frey questioned students about professors' most important characteristics and found respect and friendliness to be the most important, followed by knowledge of the material. This was similar to Feldman's (1976b) findings that respect and friendliness were rated highest, followed by knowledge of topics taught, enthusiasm, and organization. Feldman pointed out that students could be basing their ratings on initial impressions and cautioned against analyzing ratings without considering all the possible influences affecting student perception. Similarly, Powell (1977) found a correlation between the level of work students were asked to complete in a class and their corresponding instructor rating, finding that although students learned less in a course with less work required of them, they gave higher ratings. Also, students who received higher grades rated their instructors more highly. Perhaps student ratings have been a large focus of higher education research because professors want to better understand the feedback they receive and how much weight it can be given. This understanding, in turn, can improve students' experiences.

Freshman Attrition

Another focus of research in the 1970s was helping college freshmen continue their studies rather than abandoning the university experience. Terenzini and Pascarella (1977) found that freshmen who eventually left without graduating were lacking places on campus where they could fit in both socially and academically. These same authors also conducted another study focused more on previous factors affecting freshmen, including high school extracurricular activities and grade point average (Terenzini & Pascarella, 1978). Interest in the topic of freshman attrition continued well into the 1980s.

Outliers

Two articles in the 1970s focused on unique topics. The first article was by Neave (1979). He concluded that higher education became less accessible to many people in the 1970s due to "academic drift," or a shift away from the institutions' founding principles. This shift caused institutions to focus more on research and less on students, especially part-time students, returning students, or students with a career background. The second article, "Innovation Processes in Higher Education," explored the tendency of systems in education to resist changes and innovations (Berg & Östergren, 1979). These outlying articles focused on higher education as an institution; overall, research in the 1970s focused primarily on student-related themes, many of which carried into the 1980s.

The 1980s: Instructor Effectiveness, Attrition, and Self-Assessment

Interest in higher education research increased in the 1980s with twice as many published articles compared to the 1970s. In a continuation of research from the 1970s, there was much interest in student ratings and the effectiveness of instructors. Researchers continued to focus on issues of attrition and retention with the development of enrollment management programs at institutions. These programs took a more comprehensive view of the university and provided ways to keep enrollment steady or increasing (Demetriou & Schmitz-Sciborski, 2011). Compared with the previous decade, self-assessment gained interest as a research focus; a literature review on self-assessment became one of the top three most cited articles in the decade. In this section, we will discuss the research on teacher effectiveness, attrition, and self-assessment, as well as a brief mention of other topics from the top 20 most cited articles, such as cheating and critical thinking.

Teacher Effectiveness

Following the large growth of Faculty Development Centers at universities in the 1970s (Lewis, 1996), the 1980s started to respond to a new set of needs. A report from the Carnegie Foundation for the Advancement of Teaching in the late '70s, which criticized current college teaching practices (Gaff, 1999), caused institutions to more carefully assess their curriculum (Watson 2019). Institutions considered "general education, review[ed] majors and minors, embedd[ed] writing across the curriculum, address[ed] diversity issues, and incorporat[ed] international perspectives" and also

encouraged faculty development centers to focus on “mental processes and conceptual constructs” alongside student behavior (Watson 2019). Later, in the 1990s, this translated to an amendment of the earlier Higher Education Act requiring institutions to produce instructor report cards (Sass, 2021).

Many of the most cited articles in the 1980s carried a major theme of effective teaching and developing faculty teaching ability. One of the most influential articles (the second-most cited in the 1980s) discouraged additive approaches to learning—the types of teaching that viewed students as a ‘vessel to be filled’—labeling them as ineffective and encouraging more interactive and contextual approaches to teaching (Biggs, 1989). This reflects the decade’s major shift away from behaviorism towards more cognitive methods and attitudes about teaching.

Four meta-analyses on effective teaching were also heavily cited in the ‘80s, the first of which came out in 1980 and combined two studies addressing the effectiveness of student ratings on teaching. Researchers found a modest improvement in teacher effectiveness due to student ratings; in the second study, however, researchers found a more marked increase in effectiveness when student ratings were combined with colleague consultation (Cohen, 1980).

The other three meta-analyses were performed by the same author, Feldman, whose work in the 1980s appeared as five of the most cited articles, the same number among the top 20 as in the 1970s. Much of Feldman’s research in the 1970s was focused on student ratings, and this continued into the 1980s. Chronologically, the first of Feldman’s analyses investigated the connection between faculty research productivity and teaching. He found the effect so small as to be unrelated (1987). Feldman’s 1988 analysis centered on student ratings, stemming from a general concern about the criteria students used to rate teachers. He found that students’ and teachers’ views on what constitutes effective teaching were rather similar; both groups placed high importance on teacher preparedness and organization, clear and understandable instruction, and sensitivity to class level and student progress. Some importance was placed on instructors being open to discussion and other opinions in class, but he found instructor enthusiasm, personality, and research productivity to be relatively unimportant.

Feldman’s (1989) last meta-analysis of the decade considered instructor effectiveness as rated by the teachers themselves, current and former students, and colleagues and administration. He compared the ratings of current students, colleagues, and administrators, and he found the latter two groups gave the most similar ratings. Surprisingly, it was not the teachers themselves and students who had the most similar ratings. Feldman interpreted the results of this research to mean that either (a) teachers already thought they knew how their students would rate their strengths and weaknesses and rated themselves accordingly (but wrongly), or (b) teachers really did not know how students would rate them.

Attrition

By the 1980s, attrition concerns had been plaguing institutions for 20 years (Metzner & Bean, 1987). Concerns continued for two main reasons: a desire to develop and improve theories explaining student behavior and because attrition is costly to the student and the institution alike (Metzner & Bean, 1987). This research, however, could not stop a decline in enrollment at universities by the end of the 1970s. These factors led to the development of enrollment management in the early 1980s (Demetriou & Schmitz-Sciborski, 2011) whereby student retention became one part of a university-wide approach to recruitment and marketing. Three of the most cited articles in the 1980s were empirical studies of attrition and retention in universities.

Bean’s 1980 publication on attrition was the most cited article of the decade. His research focused on attrition by applying an employee turnover model to a group of university freshmen, thereby developing a causal attrition model to investigate reasons students might stay at or leave a university. Both male and female students were found to have been most affected by the perceived institutional commitment to students, but secondary reasons for departing differed: GPA was the second-most cited reason males left, and performance was the second-most cited reason for females (Bean, 1980). Several years later, the causal model was a topic of further interest. As a second part of the research, the model specified “intent to leave” as the most significant variable affecting students. Unexpectedly though, a student’s major or job certainty correlated positively with intentions of leaving. Bean explained this correlation with the

recognition that a student's interest in a job not requiring a degree, or a student's certainty about a major of study better served at another institution, would cause them to intend to leave (Bean 1982). Bean and Metzner further adapted the model for non-traditional students and published research in 1985 concerning the rise in non-traditional students—such as part-time students, older students, and commuters—and found that “nontraditional students [were] more affected by the external environment than by the social integration variables affecting traditional student attrition” (Bean & Metzner, 1985, p. 485). By the late '80s, Metzner and Bean revised the model even further and used it to investigate specific reasons non-traditional students were leaving a university. They found the two most significant variables to be related to academic performance (GPA and previous high school performance) and commitment to the institution, which involved things like enrolling for fewer credit hours or ongoing intent to leave. They offered a variety of approaches for retaining nontraditional students, such as entrance assessments and career or faculty counseling, in an attempt to increase the students' perceptions of the institution (Metzner & Bean, 1987).

Self-Assessment

Self-assessment was another highly cited topic in 1980s education research, with a literature review of the research on self-assessment among the top three most cited articles. According to Boud and Falchikov (1989), two publications laid the groundwork in this area. The first was an influential book, *Freedom to Learn for the '80s* (Rogers 1983), which analyzed “the nature and politics of the assessment process.” The second publication was “Assessment Revisited” (Heron 1988), in *Developing Student Autonomy in Learning*, which discussed “the role of self-assessment in promoting student responsibility for learning” (Boud & Falchikov, 1989, p. 531). These works propelled interest in self-assessment research forward, culminating in the 1989 literature review of self-assessment studies to that date, which sought to incorporate self-assessment research completed from the 1930s (Sumner, 1932) through the 1980s.

In 1986, an empirical study compared the grading of tutors (today, they would be called “teaching assistants”) with a collaborative, peer-created self-assessment and found them to be similar and beneficial to students (Falchikov, 1986). This research also found that older students had less tendency to over-inflate their grades on the self-assessments.

By the end of the decade, two influential researchers had emerged whose work focused on self-assessment: Boud and Falchikov. Boud's publications on self-assessment during the 1980s especially showed a keen interest in the topic, with ten publications during the decade.

Three of Boud's publications or co-authored publications appeared in 1989, two of which ranked in the most cited of the decade. A theoretical article, “The Role of Self-Assessment in Student Grading” (1989), focused on the role of self-assessment in formal grading and encouraged its adoption in higher education. Based on evidence from previous research finding that students graded themselves as consistently as staff (Boud & Falchikov, 1989), the article recommended strategies for incorporating self-assessment: scheduled grading with marks moderated by staff, grading moderated by peers, weighting grades based only on the quality of the self-assessment, counting grades by students only after demonstrated competence in self-assessment, or implementing grade contracts (Boud, 1989).

A literature review (the first of its kind on self-assessment) and meta-analysis were also published the same year by the research team. The team's review of the literature found some inconclusive results but also identified a clear link between students' overall ability and capability of assessing themselves (Falchikov & Boud 1989). The researchers found students who lacked ability overall tended to overassess themselves. The meta-analysis (Falchikov & Boud, 1989) evaluated important corresponding factors between instructor grading and student self-grading, including (a) the quality of the design study and the importance of having closer student-teacher correspondence; (b) the course level, with students in advanced courses appearing more accurate; and (c) the area of study, with science courses producing more accurate student self-assessors. Boud continued to publish extensively, and several other of his articles also made an impact by citation count in future decades.

Outliers

Many other topics appeared in the list of most cited articles, but unlike teacher effectiveness, attrition, and self-assessment, they were single-topic articles; no other articles of the same topic were as highly cited in the 1980s. These

articles are discussed in chronological order. First, Fox's (1983) article focused on theories of teaching. His article was more a collection of observations than a research study or theoretical model development, but it attempted to categorize teachers' teaching theories, which Fox claimed influenced teaching style. Another article focused on knowledge creation (Eraut, 1985). In a preview of research in future decades, Eraut analyzed the connections between higher education and the employability of graduates. His research encouraged institutions to recognize the expertise based outside university systems and that students' ability to access that knowledge and create knowledge was a valuable skill for employment.

Other unique themes in 1980 were cheating, critical thinking, non-native English speakers, and study skills. One empirical study identified three factors as impactful to student cheating: immaturity, lack of commitment to academics, and a neutralizing attitude toward the practice of cheating (Haines et al., 1986). Another researcher used a literature review to discuss the possibilities of improved critical thinking by students attending a university (McMillan, 1987). Other researchers highlighted faculty perceptions of the highest needs of non-native English speakers (Samuelowicz, 1987). In 1988, a three-part study evaluated effective ways to study and implement an accompanying study pack in a large open-enrollment math course (Vermunt & Van Rijswijk).

The final theme in the single-topic articles from 1980 was student ratings and student achievement. Feldman (1989), mentioned previously as the most cited researcher in the 1970s and 1980s, completed a meta-analysis using the same data and extending the previous work of Cohen (1980, 1981, 1987). Feldman found a good association between student achievement and perceptions of students' own learning and a modest connection between student achievement and the instructors' openness and encouragement of discussion. He found less correlation between student achievement and instructor impartiality and none between student achievement and course difficulty or workload.

Research in the 1980s increased the focus on students in the following ways: (a) engaging students, (b) understanding their experiences in learning and assessing themselves, (c) discussing students' perceptions of their instructors, and (d) recognizing their reasons for staying or leaving the university. These were all themes present in the most cited articles of succeeding decades.

The 1990s: Student-Centered Learning and Ethnicity, Race, and Power Structures

The 20 most cited articles from the 1990s built on themes from previous decades—improving the effectiveness of instructors, creating active instead of passive learning environments, addressing attrition rates, and discovering more about cheating on college campuses.

In addition to the established research trends, other emergent topics appeared within the top 20 most cited articles, indicating a shift in research priorities within higher education. For the first time, the most cited articles of the decade included research on race and ethnicity from a critical theory perspective, and postmodern ideals began to receive representation, addressing issues of power structures within institutions of higher education.

Student-Centered Learning

One of the strongest themes throughout these highly cited articles in the 1990s was reshaping the student experience based on constructivist models of learning, where learners could be active participants in constructing their own knowledge based on previous experience. Researchers were interested in the shift from surface-level to deeper-level understanding when students were required to engage as active participants.

Changes in Teaching to Promote Constructive Learning

Research from this decade recognized the deficiencies of past models of learning, which were teacher-focused with an emphasis on information transmission. Biggs (2014) explained,

Until the nineties, teaching in universities was generally seen as a departmental responsibility, which in most cases devolved to the discretion of individual teachers to teach pretty much how and what they wanted to, in the name of 'academic freedom'. The result was a huge range in the quality of teaching and learning, from the irresponsibly bad to the individually excellent (pp. 9–10).

Research from this era called on teachers to replace former practices of information transmission with learning activities that allowed students to actively construct knowledge (Biggs, 1996; Trigwell et al., 1999).

The most cited article of the 1990s was a proposal for how to integrate the well-established principles of constructivist learning with good instructional design (Biggs, 1996). Biggs noticed the divide between the espoused theories and actual theories-in-use of practicing teachers. He developed a theory, Constructivist Learning, to align principles of constructivism with the learning objectives, activities, and assessments that were actually happening in the classroom. The number of references to his work suggests the widespread recognition of the need to integrate theory and practical applications.

Many researchers found that when teachers replaced information transmission with a more interactive learning environment, students were better able to construct their own knowledge. Vermunt (1996) stated that education is "an active, self-directed, constructive process" (p. 48). He investigated whether learning activities actually led to learning and advocated for teachers to encourage students to discover meaning and application, instead of relying on reproduction. Boud and Walker (1998) argued that reflection activities were problematic "when combined with a teacher—rather than a learner—centered approach to education" (p. 193). They posited that reflective activities were only effective in classroom environments where students were invited to discover meaning and understanding rather than memorizing answers to regurgitate on a test. Trigwell et al. (1999) compared teachers' descriptions of their teaching with students' perceptions of their learning. Their interviews confirmed that students felt the teachers' instruction was better when it required active participation and deeper engagement with the material. Their perception was that merely transmitting information led to lower learning outcomes. The Trigwell et al. (1999) study demonstrates another instance of a theme of students viewing themselves more as consumers of their education and demanding higher quality learning from their teachers.

Ramsden (1991) noted that performance indicators in higher education measured faculty based on their research without assessing the quality of their teaching. In response, he created a Course Experience Questionnaire (CEQ) where student evaluations could be used to measure the quality of teaching and give students a method to hold faculty accountable for the quality of their teaching. Harvey and Green's (1993) theoretical article concluded that improving the quality of education involved empowering students to evaluate their learning and the programs of the institution, to make selections about their learning, and to develop critical thinking skills.

Using Assessment to Facilitate Learning

Considering how assessments could be used to facilitate deeper learning was also important to researchers in the 1990s. Dochy et al. (1999) noted that the goal of testing had shifted significantly enough to merit using a different term: assessment. Since the purpose for assessments was no longer just as a measurement of the final grade, Dochy et al. argued for the integration of instruction with assessments to provide students with opportunities to learn more deeply. They recommended making assessments more true to life through "authentic tasks" and using assessments as "tool[s] for learning" (pp. 331–332).

Scouller (1998) also addressed the connection of assessment to learning by considering how students prepared for assessments. She required students in a course to take a multiple-choice test and write an assignment essay. After completing both assessments, students reflected on their experience, noticing that they used surface-level learning approaches for the multiple-choice test and deeper-level learning strategies in writing the assignment essay. The results suggested that the form of assessment can affect the way students learn the material.

Although Boud et al. (1999) researched the effects of peer collaboration on learning, they discovered that assessment choices could undermine students' willingness to fully engage in collaborative work. The study concluded that

“[a]ssessment exerts a backwash effect on learning” if it encourages surface-level regurgitation (pp. 418–419). Conversely, the authors suggested that when assessments are carefully selected, they can simultaneously move students toward more effective learning and encourage, rather than discourage, peer collaboration.

Influence of Peer Interactions on Learning, Retention, and Cheating

In addition to Boud et al. (1999), many researchers in the '90s studied how peer interaction impacted students' learning experiences. Topping (1996) found that the metacognitive work involved in students' ability to act as peer tutors led to a deeper understanding of the subject matter. Tinto's (1997) research also concluded that students' learning improved when classes were structured with social interactions in mind. Students placed in a Coordinated Studies Program with the same peer group worked together more collaboratively to construct knowledge, rather than relying solely on a teacher's instruction.

Tinto's 1997 study on peer collaboration led to additional research on the impact of student involvement on both learning and retention. Tinto (1998) discovered that when students became socially and academically involved in college, both learning and persistence improved. He found involvement was especially important during the first year of college since that was the year with the highest rates of attrition. In Astin's (1999) research on the power of student involvement, he developed a theory positing that “[t]he amount of student learning and personal development associated with any educational program is directly proportional to the quality and quantity of student involvement in that program” (p. 519). He found student–faculty involvement particularly influential, similar to Nagda et al.'s (1998) findings which confirmed early student–faculty involvement to have drastic influences on retention.

Interestingly, two articles focused on one specific form of student involvement: service. Bringle and Hatcher (1996) argued that universities were uniquely positioned to offer community service. Their research suggested a curricular model for expanding student service opportunities where universities offered courses with service assignments built into the curriculum. They argued that such courses would provide both a chance to get involved and a chance to learn through written or verbal reflections. Astin and Sax (1998) also studied the impact of service involvement on learning, concluding that participation in service “enhances the student's academic development, life skills development, and sense of civic responsibility” (p. 251). Although opponents argue that serving in the community will take time away from studies, Astin and Sax found a positive correlation between giving service and all 10 academic outcomes tested, including student persistence in completing degrees.

Unfortunately, research in the 1990s found that not all peer interactions strengthen learning outcomes, rather the opposite, that some peer interaction is connected with academic dishonesty. Whitley (1998) conducted a review of literature on cheating in higher education spanning 26 years from 1970–1996. His review of 107 articles revealed one factor correlated with cheating to be “perceiving that social norms support cheating” (p. 235). McCabe and Trevino (1997) also found that peer interactions influenced cheating. In their empirical study of students from nine universities, they discovered many factors that influenced whether undergraduate students would cheat, with peer disapproval being the strongest deterrent to cheating. Their findings suggested the need for students to be the driving force in creating a social environment on campus that supports academic honesty.

Ethnicity, Race, and Power Structures in Higher Education

Notably, only two articles of the 20 most cited in the 1990s dealt directly with issues of diversity and inclusion in higher education (Hurtado et al., 1998; Nagda et al., 1998). Hurtado et al. (1998) provide the clearest example of critical theory research in the articles we reviewed, acknowledging that “[p]robably few policy areas of higher education have received more recent attention than the issue of race on campus” (p. 279). To give this statement context, they reviewed and summarized much of the literature through the framework of considering historical, structural, psychological, and behavioral climates of race in higher education institutions. Then, the authors made strong recommendations for actions that are needed in order to address the concerns that emerged from the research.

Improving higher education for minority students was also a focus in the study conducted by Nagda et al. (1998). In this study, Nagda et al. determined whether or not retention rates increased when students were integrated into strong

communities of academic and social support. First- and second-year students were placed into research partnerships where they worked closely with faculty, had access to peer mentors, peer support groups, and faculty advisors and received other academic services. Although retention rates improved for all students who participated in the study, minority and at-risk students benefited the most from the intervention. Studies such as those conducted by Nagda et al. demonstrated an increased awareness of the need to make learning opportunities in higher education more equitable, particularly in terms of access for minority groups.

In addition to critical theory research, postmodern ideals, such as deconstructing the inequitable power structures of higher education, were woven into many of the highly cited articles from this decade. Lea and Street (1998) suggested that many of the traditional power structures of university settings posed challenges to students in developing academic writing skills. In researching challenges with writing, they considered three areas: students, student-tutor work, and institutions. They concluded that “all three . . . are located in relations of power and authority” (p. 170), and the authors formulated an academic literacy framework to address the problems they saw.

While Lea and Street (1998) wrote about the need to deconstruct power overtly, power deconstruction was also an underlying theme in several other highly referenced articles. Ramsden (1991) advocated for students to have a greater voice in the university through assessing their instructors’ performance. Boud et al. (1999) addressed the way assessments create an imbalance of power when they concluded that “[a]ssessment is the principle mechanism whereby staff exercise power and control over students” (p. 418). And Boud and Walker (1998) encouraged teachers to carefully consider their use of reflective activities in classrooms because acquiring too much personal information may lead to a “misuse of power” (p. 195). Although this was the first time these research paradigms appeared in the top cited articles, they quickly became common features in higher education research.

As we continued to review the decades after the turn of the century, we found many of the well-established topics of the past being studied through critical theory and postmodern research. Other themes related to student-centered learning continued to evolve from the 1990s into the following decades.

The 2000s: Student Success, Internationalization, Teaching and Learning Practices, and Survey Response Bias

The top cited higher education research during the turn of the 21st century continued to discuss the strong themes of student support and success from previous decades. This is apparent through the abundance of literature focused on varying aspects of retention, engagement, supporting feedback, and proper preparation of college students. Authors in this decade also revealed an emerging focus on the internationalization of education, including perceptions of discrimination toward international students. Researchers in this decade focused attention on effective teaching and learning practices, such as conceptual frameworks for teaching and learning, and the alignment of assessment with long-term learning. Similar to previous decades, authors addressed feedback conceptually and proposed it as a specific way to support college students. Additionally, the growing effects of widespread internet adoption influenced top publications of this decade with a new focus on the potential biases of online versus paper survey responses.

Student Success

At least half of the 20 most cited publications of the 2000s could be categorized by a focus on student success, with the most cited article on formative assessment and feedback leading the way. Nicol and Macfarlane-Dick (2006) proposed that formative assessment and feedback could be used as self-regulation tools and techniques to help students take control of their own learning, creating a proactive, rather than reactive, role in their success. Specifically, the authors proposed principles of good feedback practice with implications for teacher implementation and allowing for greater facilitation of student success.

A pronounced theme related to the idea of student success was student engagement. Several authors addressed various angles of this influence on student success, three of which focused specifically on the effect of student

engagement on first-year college students. Kuh et al. (2008) found student engagement in educationally purposeful activities to have a positive relationship with grades in the first year and student persistence into the second year of college. Similarly, Carini et al. (2006) confirmed that engagement could support first-year college students and seniors in their academic achievement and higher performance on critical thinking tests. Other researchers arrived at similar, positive findings and concluded that students with the lowest ability benefited the most from increased attention to engagement (Carini et al., 2006).

Kuh (2009), a repeat author in the category of student success, focused a literature review on the benefits of student engagement in educationally purposeful activities, specifically focusing on students coming from low-income or historically underserved backgrounds. Kuh found that engagement increased the odds that these students would achieve their academic goals. Krause and Coates's (2008) research provided a different but confirming perspective. They reported on calibrated scales of student engagement and considered implications for policy and pedagogy that could enhance the quality of the student experience.

Parallel to the research of student engagement, other top cited authors in this decade devoted efforts to the study of student success as related to student retention, students' perceptions of the learning environment, and the mentoring of college students. Tinto (2006) conducted an extensive literature review examining past and present research on student retention. He acknowledged the complex components that influenced student persistence and identified specific areas of future research and practice.

Lizzio et al. (2002) investigated the relationship between students' perceptions of their environments on their academic outcomes and success. The researchers analyzed responses from a large, cross-disciplinary sampling of college students according to "hard" (academic achievement) and "soft" (satisfaction and development of key skills) learning outcomes. Results indicated that students' perceptions of their current learning environment were an even stronger predictor of learning outcomes than their prior academic performance was.

Through an extensive, critical review of the literature spanning almost two decades, Crisp and Cruz (2009) made efforts to reframe and update definitions and characteristics of mentoring and presented theoretical perspectives on the effects of mentoring college students, specifically from the literature of business, psychology, and education.

Lastly, other researchers studied yet another component of student success: considerations for the success of students post-graduation. Bridgstock (2009) acknowledged that shifts in the education and labor markets of the time were placing increased pressure on universities to produce more employable graduates, even though there was no agreement on how employability was defined. In her highly cited article, Bridgstock proposed that more than skills, graduates needed to be able to proactively navigate the world of work and self-manage the career process. More specifically, in a combined literature review and four-year longitudinal study, Austin (2002) argued that graduates seeking to fill available faculty positions must demonstrate even more talent than their predecessors. She also identified reforms that would guide changes in education to better prepare students for the realities of the academic workplace.

Internationalization of Education

Research in the 2000s brought new insight into the internationalization of education. Altbach and Knight (2007) proposed that intentional efforts to stay aware of international initiatives and ensure quality are essential to the environment of international higher education. They also offered important and helpful clarification about the distinction between the meaning of globalization and internationalization of education, explaining that globalization is the context of the economic and academic trends of the century, while internationalization refers to the policies and practices of individuals and academic institutions that adapt to the global academic environment. This distinction offered an important lens through which to view the remaining top cited articles on the internationalization of education.

Knight (2004) updated the conceptual frameworks of internationalization in light of the changing world of higher education, studying the meaning, definition, rationales, and approaches to internationalization from the perspective of

the institutional level, a bottom-up view, where she argued the real process of internationalization takes place, and from the national/sector level, a top-down view encompassing policies, funding, and programs. Through this framework, she identified key questions and policy issues essential to the future direction of internationalization.

Deardorff (2006) recognized that a move toward internationalization increased the need for intercultural competence. Deardorff (2006) sought to define intercultural competence and determine an appropriate assessment with which to measure this competence as a student outcome of these efforts. She found that both intercultural scholars and administrators agreed that it was possible to assess cultural competence by degrees, and two models of intercultural competence were presented in the findings of her article.

Further top cited research of internationalization in the decade focused on the reality of national and global competition in higher education. Marginson (2006) noted that higher education, along with potential research performance, has been postulated as 'positional goods' that increase income earnings and social prestige. He noted a worldwide market of elite universities in the United States and United Kingdom and the reality that the English language dominates the research capacity. Marginson's work proposed the need for a more balanced distribution of capacity globally.

Finally, with the growth of education globalization and the increase of intermingling multicultural students, opportunities increased for either hospitality or unfair treatment towards international students. In a frequently cited article, Lee and Rice (2007) analyzed the experiences of international university students at a Southwestern university in the United States. Based on the conceptual framework of neo-racism, the authors conducted interviews to explore the students' perceptions of discrimination. The researchers concluded that some of the challenging issues faced by international students were not just matters of adjustment, as much of the research had suggested, but they could also represent inadequacies within the host society.

Teaching and Learning Practices

Efforts to improve teaching and learning practices were also evident in varying forms in the top cited literature from 2000 to 2009. Researchers Meyer and Land (2005) addressed complex issues of threshold concepts within and across disciplines, with an effort to transform the internal view of subject matter. They sought to (a) examine these concepts within the personal understanding of discipline-specific discourses, (b) develop more extensive notions of boundaries and borders, and (c) provide a conceptual framework teachers could use to advance their own reflective practice.

Addressing very different aspects of teaching and learning practices, and similar to previous decades, researchers Boud and Falchikov (2006) examined the alignment of assessment with long-term learning. They discussed the kinds of practices needed to refocus the placement of assessment within higher education and explored the characteristics of assessment tasks that might be used to promote a more sustainable approach to helping students with future learning challenges.

Lastly, Carless (2006) contributed to the growing body of research from previous decades concerning perceptions in the feedback process. Carless argued that assessment dialogues were a way to potentially help resolve some of the issues of trust and misconception that at times may be unwanted outcomes in the feedback and assessment process.

Survey Response Bias

The 2000s also brought the emergence of widespread internet use. This change was manifest in the top educational journal articles through an interest in online- versus paper-survey response bias. Two articles by different authors addressed this topic from similar perspectives, through different methods. Nulty (2008) offered a review of online surveying in general, including a review of data and practical advice to help boost survey response rates. Additionally, Nulty offered recommendations to improve the effectiveness of this evaluation strategy. Similarly, Sax et al. (2003) addressed survey response bias. They collected and analyzed data from first-year college student surveys, which had been administered in four forms: paper-only, paper with web option, web-only with response incentive, and web-only without response incentive. Results indicated that the mode of administration had an effect on response rate.

In summary, the continued themes of student support and success, effective teaching and learning practices, and feedback continued in the 2000s from previous decades. The 2000s also brought an emerging focus on the internationalization of education and the growing interplay between technology and education. These themes persisted into the coming decade.

The 2010s: Economy, Student Experience, and Gender Equality

In the 2010s, new topics developed such as the influence of the economy and gender equality in education. Student experience continued to be a prevalent theme in this decade. Much of the research in this decade also responded to the economic, social, and educational challenges from the previous decade.

Economy

The economy played an increasing role in education research during the 2010s. “Between 2000 and 2018, total undergraduate enrollment in degree-granting postsecondary institutions increased by 26% (from 13.2 million to 16.6 million students)” (National Center for Education Statistics, 2021). This rapid increase was likely driven by a growing global and highly competitive knowledge-based economy requiring workers with postsecondary education and training. Barro and Lee (2013) argued that education is essential in a knowledge-based economy because it increases the ability of a workforce to carry out existing tasks more quickly and promotes the transfer of knowledge about new information, products, and technologies. Marginson (2016) stated, “this worldwide trend foreshadowed a world in which knowledge, skills, and personal agency would be much more widely distributed” (p. 414). Marginson’s top cited research in the 2010s discussed the effects of high participation in tertiary education on social stratification and inequality. Recognizing the universal desire for social betterment is articulated through higher education systems, he argued that the quality of mass higher education could be problematic and there was a limit to the number of socially advantaged positions on offer. He claimed that higher education “can never bring every family what it seeks” (p. 415).

Consumerism

The global financial crisis of 2007–2008 was considered by many economists to have been the most serious financial crisis since the Great Depression (Williams, 2010). This event spotlighted the link between the economy and education and caused governments to expand higher education while at the same time reducing public expenditure and shifting more costs to students. Students, now paying more in tuition and fees, were viewed not just as students, but consumers of education. Students as consumers (SAC) viewpoints shifted power from providers to consumers, who, with more control over expectations and the ability to evaluate services, expected higher standards and quality of service (Tomlinson, 2014). Universities have not historically regarded education as a product or service, so the SAC approach represented not only a political and financial shift in higher education but also a fundamental educational shift. Williams (2013) found that the SAC approach reinforced attitudes toward learning and inhibited students from taking responsibility for developing their own knowledge and skills. Researchers found that students who were personally responsible for paying their tuition fees (e.g., through a loan from student finance), as opposed to having their fees paid on their behalf (e.g., by a scholarship or employer), did express a higher consumer orientation, which, surprisingly equated to lower academic performance (Bunce et al., 2017).

Employability

The economic influence on higher education also increased policy makers’ interest in higher education’s ability to produce more measurable outcomes (Holmes, 2013), including graduate employability. Clark (2018) researched the trend of adopting skill-based learning outcomes in order to increase graduate outcomes. She developed a framework that incorporated six key dimensions—human capital, social capital, individual attributes, individual behaviors, perceived employability, and labor market factors—as a method of explaining graduate employability. Clark claimed that graduate employability remained underexplored and underdeveloped and that its complex nature had often been oversimplified.

Another top cited article approached employability by evaluating work-integrated learning (WIL) programs used to equip new graduates with the required skills to function effectively in the work environment. Jackson (2015) investigated best practices in the classroom and placement activities to both develop employability skills and identify factors impeding skill performance during WIL.

Pickering and Byrne (2014) discussed the employability of PhD candidates in terms of how they benefited from increased publication rates, emphasizing the importance of publishing early and often. The authors described a successful method used by PhD candidates and early career faculty to undertake and publish literature reviews.

Entrepreneurship

Also on the topic of economic influences, we saw a top cited article centered around entrepreneurship. Researchers and public policy makers widely recognized that entrepreneurship is an important driver of economic growth. Nowinski et al. (2019) found that entrepreneurship education does have a positive impact on the development of entrepreneurial intentions, particularly among females.

Student Experience

Student experience was a common theme throughout the research in this decade. Topics in this theme included engagement, feedback, cheating, and the use of technology. Researchers in this decade found understanding the student experience can influence policy and practice as well as improve student retention.

Engagement

Student engagement was found to be key to student achievement and retention in earlier decades (Krause & Coates, 2008). In the 2010s, Kahu (2013) found that other researchers had studied, theorized, and debated student engagement with growing evidence of its critical role in achievement and learning; it was even suggested later that the value of engagement is no longer questioned (Trowler & Trowler, 2020).

Kahu (2013) reviewed and critiqued the four dominant research perspectives on student engagement: the behavioral perspective, the psychological perspective, the sociocultural perspective, and the holistic perspective, which takes a broader view of engagement. Kahu presented a conceptual framework attempting to overcome student engagement problems and frame future research to improve student outcomes. An expansion of her framework affirmed students' engagement is influenced by a combination of student factors and institutional factors. Continued research found there were psychosocial constructs that strongly influenced student outcomes such as academic self-efficacy, emotions, belonging, and well-being. She claimed "critical mechanisms [are needed] for mediating the interactions between student and institutional characteristics and student engagement and success" (Kahu & Nelson, 2018, p. 58).

Feedback

The most prominent theme within the 2010s' top cited articles was centered on the pedagogical practice of giving and receiving feedback. This trend was probably also influenced by the SAC approach as faculty were expected to be increasingly available to students and to respond more promptly to questions and concerns.

Giving students detailed feedback about the strengths and weaknesses of their work, with suggestions for improvement, is common practice in higher education. Building upon feedback research conducted in previous decades, this decade produced diverse approaches to the topic. Nicol (2010) worked with a goal of understanding the purpose of feedback and increasing its effectiveness, concluding his research with a call for wider changes in teaching and learning and in the pedagogical models underpinning feedback designs. Additional research completed by Nicol et al. (2014) consistently showed that students were less satisfied with feedback than with any other feature of their courses. Another highly cited article even went so far as to argue that feedback seems to have little or no impact, despite the considerable time and effort put into its production (Sadler, 2010). One qualitative investigation led researchers to argue that effective feedback should lead to demonstrable improvements in student work and learning strategies (Dawson et al., 2019).

Other research findings from the 2010s proposed criteria for understanding and applying feedback. For students to be able to apply feedback, they need to understand the meaning of the feedback statements (Sadler, 2010). They also need to identify the particular aspects of their work that need attention. In order to identify those aspects, Sadler asserted that students must possess critical background knowledge.

Some of the feedback research presented possible suggestions for improvement to existing feedback models. Carless and Boud (2018) identified four interrelated features underpinning students' feedback literacy: appreciating feedback; making judgments; managing effect; and taking action. In addition, teachers were identified as playing important facilitating roles in promoting student feedback literacy through curriculum design, guidance, and coaching. Another article explored a model that positioned learners as having a key role in driving learning, enabling them to generate and solicit their own feedback. Boud and Molloy (2013) identified the design of the curriculum as an important means of encouraging students to operate as judges of their own learning. Researchers also identified learning benefits resulting from giving and receiving peer feedback (Nicol et al., 2014). Finally, researchers reviewed the skill of evaluative judgment to improve feedback, suggesting that the capability to make decisions about the quality of one's own and others' work should be a goal of higher education. Researchers argued that employing evaluative judgment within a discourse of pedagogy would enable students to improve their work and to meet future learning needs (Tai et al., 2018).

Technology

Research in the 2010s also discussed some of the ways in which technology continued to change the student experience. Interest in flipped classrooms grew exponentially after the introduction of the model in 2011. In the top cited article of this decade, researchers attempted to provide a catchall definition for the flipped classroom, while at the same time retrofitting it with a pedagogical rationale. Researchers found that despite the enthusiasm of the approach, well-designed, rigorous research on flipped classrooms was lacking, causing the researchers to construct a theoretical argument that flipped approaches might improve student motivation and help manage cognitive load. But, they also encouraged more specific types of research on the effectiveness of the flipped classroom approach (Abeysekera & Dawson, 2015).

Another technology-focused study explored the potential use of various digital technologies to enhance student learning. Henderson et al. (2017) attempted to show that digital technologies were central to the ways in which students experience their studies but also found that those technologies were not transforming the nature of university teaching and learning. They issued a call for university educators to temper enthusiasm for what might be achieved through technology-enabled learning and encouraged a better understanding of the realities of students' encounters with digital technology.

Cheating

In 2015, a series of reports by the Australian media suggested there was a potentially large and unaddressed problem of Australian university students outsourcing their assessments to third parties—a behavior termed “contract cheating” (Bretag et al., 2018). Researchers sought to explore students' experiences with, and attitudes towards, contract cheating and the contextual factors that may influence this behavior. Their findings suggested that to minimize contract cheating, universities needed to support the development of teaching and learning environments that nurture strong student-teacher relationships, reduce opportunities to cheat through curriculum and assessment design, and address language and learning needs of students speaking a Language Other than English (LOTE) at home (Bretag et al., 2018).

Gender Equality

For the first time, research in the 2010s addressed topics within feminist research. One study attempted to determine how the gender of an instructor influenced student ratings. The researchers did not disclose the gender of the instructors in the study, so the instructors were able to teach an online course while operating under a different gender identity. The researchers discovered that students rated the male instructor significantly higher than the female instructor, regardless of the instructor's actual gender (MacNeill et al., 2015). Researchers believed this information about gender biases could have a significant effect on academic career trajectories. Other research considered how

gender influenced the amount of academic service performed by faculty. Using data from a large U.S. national survey and an online performance reporting system, researchers discovered evidence that on average female faculty performed significantly more academic service than male faculty (Guarino & Borden, 2017).

Our synthesis of this decade shows the prominence of teaching and learning research topics that were centered around improving the student experience. Of special note in this decade is the introduction of research showing how technology was changing the educational landscape in higher education. We were also surprised feminist scholarship in higher education research didn't emerge within the article database until this decade.

2020 and Beyond: Academic Research, Partnerships and the Economy of Education, Employability, Teaching and Learning Practices, and Online Learning

Beginning the decade, research in 2020 was directed at improving higher education practices. Some research focused on improving academic research itself, while other research focused on relational and pedagogical practices. Researchers examined how students and staff interact and what impact that has on students' education. Some articles discussed employability of graduated students, while other articles discussed the impact of online learning in college education. These themes from the research in the beginning of the 2020s provide insight into what the future of higher education research may look like throughout the rest of the decade.

Academic Research

A top cited journal article of 2020 was a review of academic research by Daenekindt and Huisman (2020), who mapped and synthesized research in the field of higher education from 1991 to 2018. By creating topic models, they identified themes taken from the abstracts of thousands of journal articles. Additionally, they studied how research topics have evolved over time, which research topics occur together, and they identified gaps in the literature. They expressed concern over the disintegration of the field due to the "isolated islands" of research topics found in their work.

Other top cited authors in 2020 also focused on the topic of academic research and similarly concluded with concerns about research in the higher education field. Horta and Santos (2020) claimed that certain policies and guidelines have robbed the field of collegiality and autonomy, which are both deemed necessary for quality research. Additional studies on academic research noted and encouraged the need for greater rigor in using statistical methods like partial least squares and structural equation modeling to help avoid inaccuracies in future publications (Ghasemy et al., 2020). These articles show a reevaluation of current practices and a call for improvement in academic research.

Partnerships and the Economy of Education

Student-staff partnerships appeared as a new theme in the top cited articles of 2020. Researchers investigated various angles of this arrangement. Mercer-Mapstone (2020) proposed that student-staff relationships could help support institutional equity and diversity and foster unique experiences for both students and staff. On the contrary, Bovill (2020) argued that partnerships of small groups are generally only composed of super-engaged or privileged students and proposed instead a whole-class approach to partnership, adding that all could be co-creators in learning.

Other researchers studied the connection between partnerships and the economy of education. Gravett et al. (2020) were supportive of the concept of students as partners and went a step further to claim that these partnerships could help students become more than customers. Their research supported the theory, continued from previous decades, that education can be an economy. In a parallel way, even student evaluations can affect the economy of education, given the unintended economic consequences of their results. Esarey and Valdez (2020) acknowledged the scholarly quest for valid student evaluations and the need for accuracy. They concluded that the relationship between student evaluations and instructor quality is imprecise and that multiple, even imperfect, measures will produce more fair results.

Tight (2020b) also alluded to this knowledge-based economy as he presented research on an entirely different topic: student retention and engagement in higher education. Tight concluded that the concept of student engagement has now taken over student retention in importance. He argued that this is because of the shift of financial responsibility of higher education from the state to the student. Therefore, the concern and responsibility of student retention and engagement have shifted from the student to the educational institution. Barbera et al. (2020) also acknowledged that decades of effort have sought to identify predictors of student retention and graduation, but historically important indicators should also include newer considerations of nontraditional students and online programs. The success of those students greatly influences the educational economy.

Employability

Employability, connected to the concept of a knowledge-based economy, is a theme that continued from previous decades into 2020. Universities can have altruistic or economic interests in producing students who possess the needed skills for success in the workplace. Top cited authors Succi and Canovi (2020) found that companies value soft skills more than students and graduates do, and the researchers urged companies and educational institutions to work together to build awareness and student responsibility in acquiring and developing more soft skills. Römgers et al. (2020) researched the need to integrate approaches to employability, conceptual frameworks, and definitions. Another top cited article evaluated employability of international students returning to their own countries, specifically, Vietnamese students who had studied in Australia (Pham & Saito, 2020). Buckner and Stein (2020) also addressed aspects of education and internationalization with research efforts that identified elements of global inequality, certain ethical responsibilities, and possibilities to help.

Teaching and Learning Practices

The top cited articles of 2020 also added to the long-studied theme of teaching and learning. These topics included feedback, collaborative learning, and assessment. Molloy et al. (2020) addressed the notion of students being active participants and using feedback for their own learning. Molloy et al. encouraged a concept of feedback literacy and put more emphasis on the learners' perspective and role when receiving feedback. Their work connected with Li et al.'s (2020) work, which found that peer assessment promoted student learning and had a positive effect on student performance. Similarly, Meijer et al. (2020) researched the assessment of collaborative learning, including intra-group assessment.

Online Learning

Much of the top cited literature of 2020 reflected the adoption of online learning and its accompanying challenges. Sharma et al. (2020) addressed the level of student engagement for online learning success, showing that frequency and duration of engagement have a significant impact on grades. Thongsri et al. (2020) researched computer self-efficacy for e-learning adoption and found greater scores of self-efficacy, perceived ease of use, and intention for e-learning in STEM as opposed to non-STEM students. Other issues embedded in online learning included concerns of cheating (Chirumamilla et al., 2020) and oral examinations as an acceptable online assessment tool (Akimov & Malin, 2020).

In summary, the research of 2020 continued themes from previous decades such as the economy of education, the employability of students, internationalization, teaching and learning practices, and the influence of technology in online learning trends. However, with the educational impacts from the COVID-19 pandemic, research trends may make an abrupt shift. We anticipate both continued research on the themes discussed above and research on new themes in response to the events of 2020 as the decade progresses.

Synthesis of 50 Years: Findings, Trends, and Implications

Researchers as early as 1972 (Trow) attempted to survey the higher education field holistically and to define common topics or themes found in the research literature. Trow focused on access to the university and traced the shift from

only elite access, to mass education, and on to universal access, while other researchers since that time have attempted to categorize more general themes of higher education. Altbach (1985), Teichler (1996), and Hayden and Parry (1997) all grouped research topics based on trends. The two most comprehensive bibliographic studies of higher education literature were published recently (Daenekindt & Huisman, 2020; Tight, 2020c). Daenekindt and Huisman's top cited review mapped the field of higher education research from 1991 to 2018, categorizing themes into four broad categories, while Tight settled on eight major themes in the literature.

Findings

While many researchers have documented the trends of higher education research by focusing on output (the number of publications), our purpose was to measure the impact of publications by outcome (number of citations). We find this research significant because, as Diem and Wolter (2013) have concluded, "citations actually denote a research outcome, namely the impact of the published research papers on other people's research" (p. 88). Because our review has only focused on the trends which emerged in the highest impact articles (outcome), we find it insightful to compare these trends with those found in output reviews, specifically Tight's research, since we have found it to be the most comprehensive in terms of time and scope (2020c). Table 1 provides a topical comparison between the 120 articles we reviewed and the eight themes identified by Tight. Course design on assessment and course design on outcomes appeared consistently in the top 20 articles of each decade, suggesting a broad and ongoing interest in assessments and learning outcomes across the decades we reviewed.

Table 1

Number of Top Cited Articles Categorized Using Tight's (2020c) Research

Category	Number of articles
Course Design	61
Assessment	23
Outcomes	25
Quality	17
Teaching & Learning	14

In addition to highlighting the most represented themes, our comparison also illuminated the underrepresented trends in highly cited articles. Tight's themes of academic work, defined as "research on the roles of those who work in the academe" and knowledge, defined as "research on academic disciplines and the research process," were rarely represented in the high impact journal articles we reviewed (2018, p. 2). Only four articles focused on academic work, and only seven articles focused on knowledge.

Evolution of Trends

By studying 50 years of the most influential articles, we are able to document not only which trends existed in higher education research but also the evolution and emergence of those trends. The highly cited articles we reviewed provide evidence for a change in thinking about the broader trends over time.

Student engagement is a trend in higher education research that evolved significantly over the past 50 years. In the early decades we reviewed, the literature focused primarily on solving the problem of attrition. Early on, researchers looked for empirical evidence about how to improve retention, but by the 1990s, they were publishing extensively about increasing student retention through academic and social involvement. Findings in these studies solidified ideas of involvement—increasingly referred to as engagement—as having a significant impact on more than just retention. Learning outcomes and an improved student experience were some of the byproducts that researchers connected with engagement. In a further expansion of this trend, Tight (2020b) recently stated that future research on the topic of

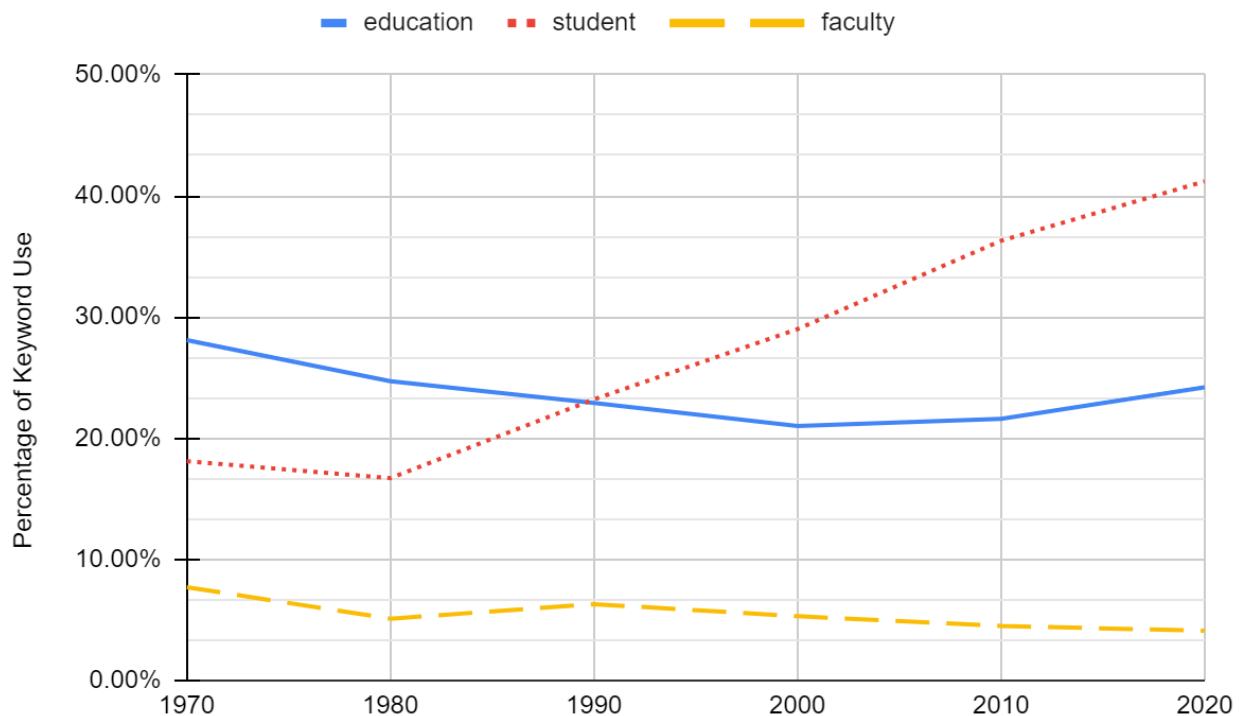
student engagement needed to seek an understanding of the complete student experience instead of narrowly focusing on engagement.

A second example of an evolving trend was the shifting role of instructors within higher education. In the early decades we reviewed, the research focused on moving instructors away from a behaviorist teaching model where information transmission and student regurgitation were the goals (Biggs, 1979; Biggs, 1989; Dahlgren & Marton, 1978; Fry & Kolb, 1979; Laurillard, 1979; Marton & Svensson, 1979). Researchers produced evidence of more effective teaching strategies based on constructivist models, including students as active participants in discovering and creating knowledge (Biggs, 1996; Boud & Walker, 1998; Trigwell et al., 1999; Vermunt, 1996). Studies showed how peer tutoring and collaborative learning experiences produced more student-centered classrooms (Tinto, 1997; Topping, 1996). And in more recent decades, the research has shown a need for professors to reexamine the way they conduct assessments and provide feedback (Boud & Falchikov, 2006; Boud & Molloy, 2013; Carless, 2006; Carless & Boud, 2018; Dawson et al., 2019; Nicol & Macfarlane-Dick, 2006; Nicol, 2010; Nicol et al., 2014; Sadler, 2010; Tai et al., 2018). Finally, the most current research has reconceptualized the role of instructors and emphasized the teacher–student partnership in teaching and learning (Bovill, 2020; Mercer-Mapstone, 2020).

A keyword analysis of the 50 years of articles we reviewed confirms this increasing attention on the student-centered approach. In the 1970s and 1980s, “education” was the top keyword in the literature we reviewed, and “student” was second on the list (see Figure 3). By the 1990s, “education” and “student” had equal representation. From there, “student” continued to climb, widening the gap in each succeeding decade. Interestingly, as “student” increased, the word “faculty” steadily declined.

Figure 3

Patterns of Top Keywords in Article Titles by Decade

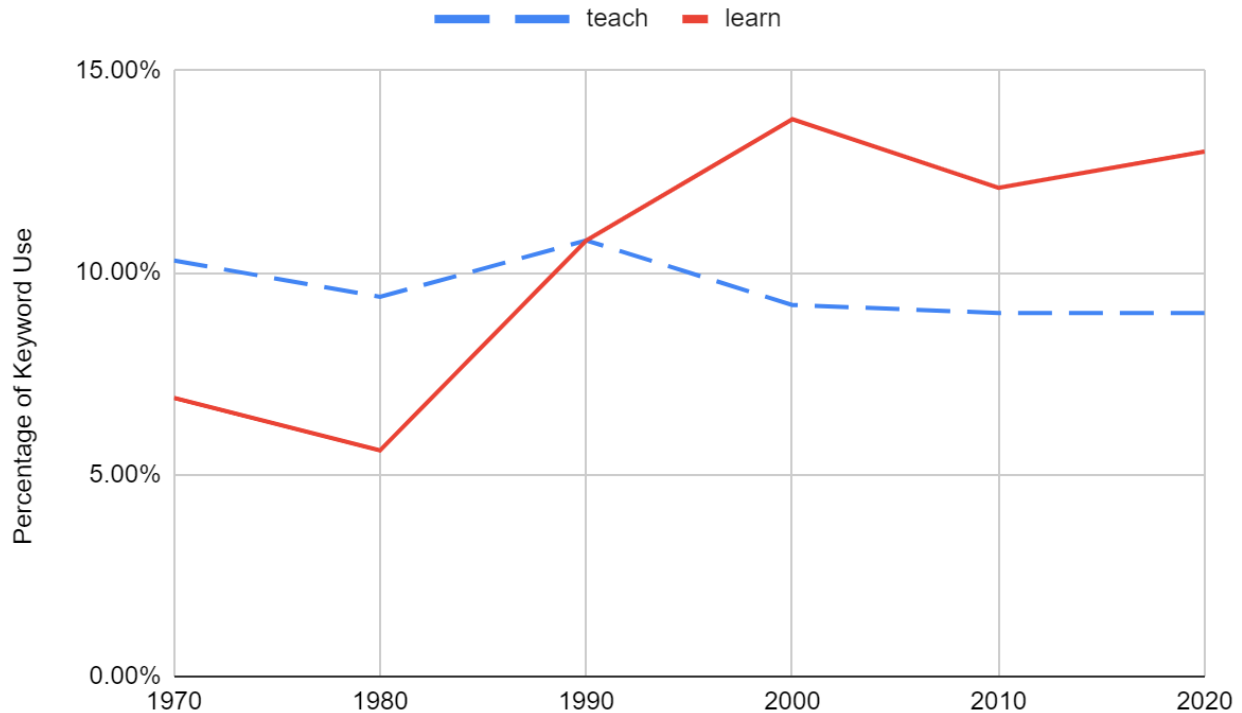


A very similar pattern occurred when we examined the words “teach” and “learn” in connection with their usage over the decades (see Figure 4). Articles in the 1970s and 1980s used the word “teach” with greater frequency than the term

“learn.” By the 1990s, the two terms were used with equal frequency but from there, “learn” overtook “teach” in frequency, with the spread increasing in each subsequent decade.

Figure 4

Patterns of Top Keywords in Articles by Decade



Emergence of Trends

In addition to providing insights into how trends have evolved, this study also demonstrates how some newer trends have emerged over the past 50 years. One clear example of an emerging trend has been the internationalization of education. In a bibliometric analysis of 20 years of international comparative studies, Kosmützky and Krücken (2014) documented the growth of international research from the 1990s through the present. One driving force behind the growth was “the establishment of new journals explicitly devoted to international higher education from the mid-1990s onwards” (p. 469). The new journals, coupled with a growing interest in globalization and international education, provided fertile ground for new research. While we rarely saw the theme of internationalization in the early decades we reviewed, the theme emerged prominently in the 2000s with five articles addressing the internationalization of education (Altbach & Knight, 2007; Deardorff, 2006; Knight, 2004; Lee & Rice, 2007; Marginson, 2006). Jing et al. (2020) confirmed this trend with their comprehensive study of over 100 years of research on international students in higher education; they found that the research has expanded significantly from 2006 to the present.

A second emergent trend we found in our analysis was the growth of research from different paradigmatic perspectives, particularly critical theory, postmodernism, and feminism. Despite a growing awareness of the need for critical theory to be applied to education in the 1970s, there was a lapse in time before researchers began to publish from this paradigm’s perspective. The Association for Educational Communications and Technology (AECT) Handbook noted this trend in higher education research concluding that “[t]hrough relatively few educators . . . appear to concern themselves directly with critical theory (McLaren, 1994a), a number of influential educators are pursuing the theory” (AECT, 2001, para. 1).

We identified this lapse by comparing the most cited articles of the 1970s and 1980s with articles of the 1990s. It was not until the 1990s that critical theory research appeared in the most cited articles. While this is not an indication of an absence of earlier critical theory research, the high number of citations speaks to the paradigm's growing interest and impact among researchers and practitioners in the 1990s and forward. Similarly, in the 1990s we found the first postmodern research study within our data set (Lea & Street, 1998). The impact of critical theory and postmodern research continued to increase as evidenced by highly cited articles in the 2000s and 2010s (Carini et al., 2006; Kuh, 2009; Lee & Rice, 2007; Marginson, 2006; Buckner & Stein, 2020; Marginson, 2016). Surprisingly, even though women were well represented as authors of the most cited articles, and feminist research and perspectives were developing, research with a feminist perspective did not appear in the top 20 articles until the 2010s (Guarino & Borden, 2017; MacNell et al., 2015; Nowinski et al., 2019).

Implications

Across the 50 years of higher education research, we noted a shift away from the assumption that teaching equates to learning. The articles that had the biggest impact on the field of higher education came from researchers who were responding to the need to make learning student-centered and were attempting to measure how the best learning happens. These types of research may have been reactions to the ideals of behaviorism that were prevalent in education prior to the 1970s. Behaviorism assumed a reflexive response to learning; as long as something went in, it would also come out. It was in the 1960s that Lev Vygotsky's work on the sociocultural, constructive nature of knowledge was introduced to the English-speaking world. The increasing realization of the complexity of learning underscores the research of these 50 years. Most of the highly impactful research responded to questions about how to help students learn deeply, how to make sure that learning is engaging so students persist in finishing their degrees, and ultimately how to ensure that earning a degree equates to marketability in a global economy. Specifically, we noticed researchers in the 1980s attempted to align teaching practices with the best student learning methods (Biggs, 1989; Biggs, 1996; Cohen, 1980; Feldman, 1988). Many studies in the 1990s showed the need to replace teaching practices that encouraged surface-level learning with deep-learning experiences (Boud & Walker, 1998; Boud et al., 1999; Dochy et al., 1999; Scouller, 1998; Topping, 1996; Trigwell et al., 1999; Vermunt, 1996). Research across several decades showed the importance of student engagement in creating student-centered learning environments (Astin, 1999; Astin & Sax, 1998; Carini et al., 2006; Kahu, 2013; Kahu & Nelson, 2018; Krause & Coates, 2008; Kuh, 2009; Kuh et al., 2008; Nagda et al., 1998; Tinto, 1998; Trowler & Trowler, 2020). Most recently, studies also viewed student-centered learning from a broad perspective regarding the relevance of education in terms of employability and usefulness in the global market (Barro & Lee, 2013; Clark, 2018; Holmes, 2013; Jackson, 2015; Marginson, 2016; Nowinski et al., 2019; Pickering & Byrne, 2014).

These research trends illuminate the way student-centered learning has become the central focus of higher education. Over the decades, keyword counts showed a shift from the terms "teach" and "education" in early decades to the terms "learn" and "student" in later decades, as evidence of the increasingly student-centered approaches to learning we saw throughout the most cited articles. As students have had to shoulder the growing financial responsibility of acquiring higher education degrees, they have sought more power to ensure the quality of their education. Themes focused on student ratings, assessments, and feedback may be related to students' growing demands to have formal education produce economic benefits worthy of the cost. Similarly, we do not find it surprising that 50% of the most cited articles focused on assessment and learning outcomes (both immediate and long-term outcomes) because these categories provide a means of measuring learning improvement efforts.

Limitations and Suggestions for Further Research

As we reviewed the highly cited articles from each decade, we noticed several authors whose work consistently received high citation counts. When we referenced additional articles published by these authors, we found some of their other highly cited work was published in journals that are not specific to higher education research. The bibliometric analysis in our study guided the selection of journals that would be included in each subdiscipline's dataset (see the Appendix for a complete list of journals). It was evident as we analyzed the articles from each decade that one

limitation of our study is that there may be other highly cited works that were not included because the journal was not a part of our dataset.

One potential area of further research would be to study how citation counts have changed over the decades and to determine what those changes mean in terms of the impact. As we compared decades and articles, we noticed the total number of citations for the most cited articles was higher in the earlier decades than the total number of citations in more recent decades. We feel it would be helpful to understand why citation counts were lower in recent years despite the overall exponential growth within higher education publications. Are journal articles receiving fewer citations because of the increasing number of publications each year? Are other sources of knowledge, such as whitepapers, conferences, internet articles, or listservs, replacing journal articles as primary influences for research ideas? Do these recent journal articles with a smaller number of citations also have a smaller impact on the broader field? Answers to these questions would be helpful in building on the findings of this study.

Conclusion

While there is still disagreement about whether higher education research qualifies as a discipline or as a multidisciplinary research field (Tight 2020a), interest in higher education as an area worthy of research and study has grown significantly in the last 50 years. In reviewing the most highly cited articles of each decade, we were able to identify the themes and trends that made the biggest impact in higher education research over the past 50 years. Themes that centered on students and learning—such as effective teaching, retention, engagement, assessment, feedback, and employability—were the most common among the high-impact articles we analyzed. Our findings suggest that the field of higher education has moved away from a teacher-centered approach to a student-centered focus where deep, applied learning is the goal.

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Research Impact Metrics

A 50-Year Analysis of Education Research Article Feature Effects on Citation Counts

Royce Kimmons & Ross Larsen

Open

Education

Education Research

Impact

By analyzing 50 years of citation counts of 51,281 research articles across 86 education journals in conjunction with textual analysis of article titles and abstracts, we explore how a variety of article features, such as title length, use of a subtitle, reading difficulty, and open access status, have historically influenced the impact of education research articles. Results indicate that (a) shorter titles are more likely to be cited than long titles, (b) articles with subtitles (designated with a colon) are more likely to be cited, (c) articles with lengthy and more technical abstracts are more likely to be cited, and (d) open access status has no effect.

The guiding research question of this analysis was “What is the relationship between education research article features and citation counts?” Central to our asking this question is the notion that citation count as a measure of impact may be influenced by a variety of factors that may have little to do with a given study’s scientific or professional merit or that subtle decisions regarding an article’s title or abstract might influence its citability. To answer this question, we utilized hierarchical linear modeling (HLM) to analyze Scopus database metrics for top education research journals to determine the strengths of relationships between two independent citation variables, six independent article feature variables, and two covariates. In total, 51,281 articles from 86 journals were analyzed, inclusively representing the years 1969 to 2020 (see Table 1).

Our independent citation variables consisted of two variations of the citation count metric provided by Scopus: (a) raw citations and (b) citations per year. Raw citations represented the total number of times that an article had been cited in its entire lifespan. As one might expect, these counts were somewhat influenced by publication date because it takes time for articles to be read and cited in subsequent publications, meaning that articles published earlier in a given year

might exhibit a citation advantage over articles published later in the same year (see Figure 1). For this reason, we also recoded raw citation counts as citations per year by multiplying the citation count by 365 and dividing this value by the number of days that had elapsed since the article had been published (see Figure 2). This recoding helped control for elapsed time but also revealed a general positive relationship between year published and citations per year, suggesting that more recent articles were being cited at a higher rate than their predecessors. Uncertain of which of these two metrics would be the most reliable for accounting for complexities of time, we constructed separate models for each to see if results converged to tell a similar story.

Figure 1

Average Article Raw Citations by Year Published ($R^2 = 0.28$)

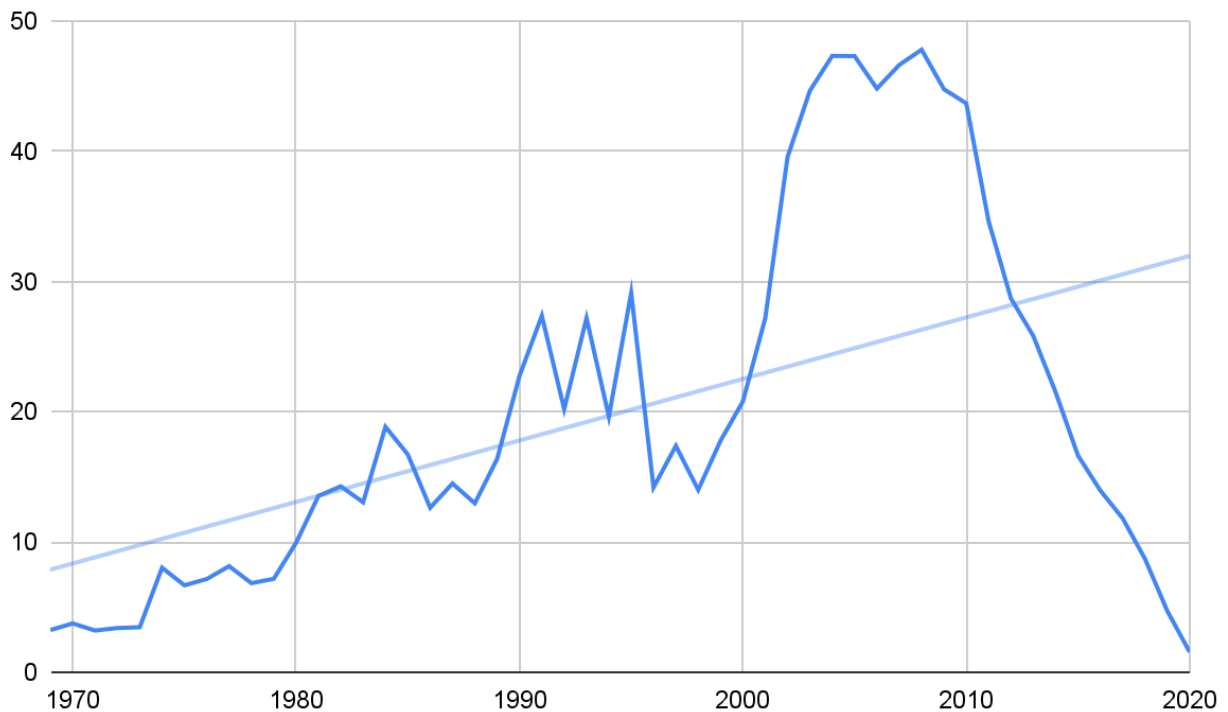
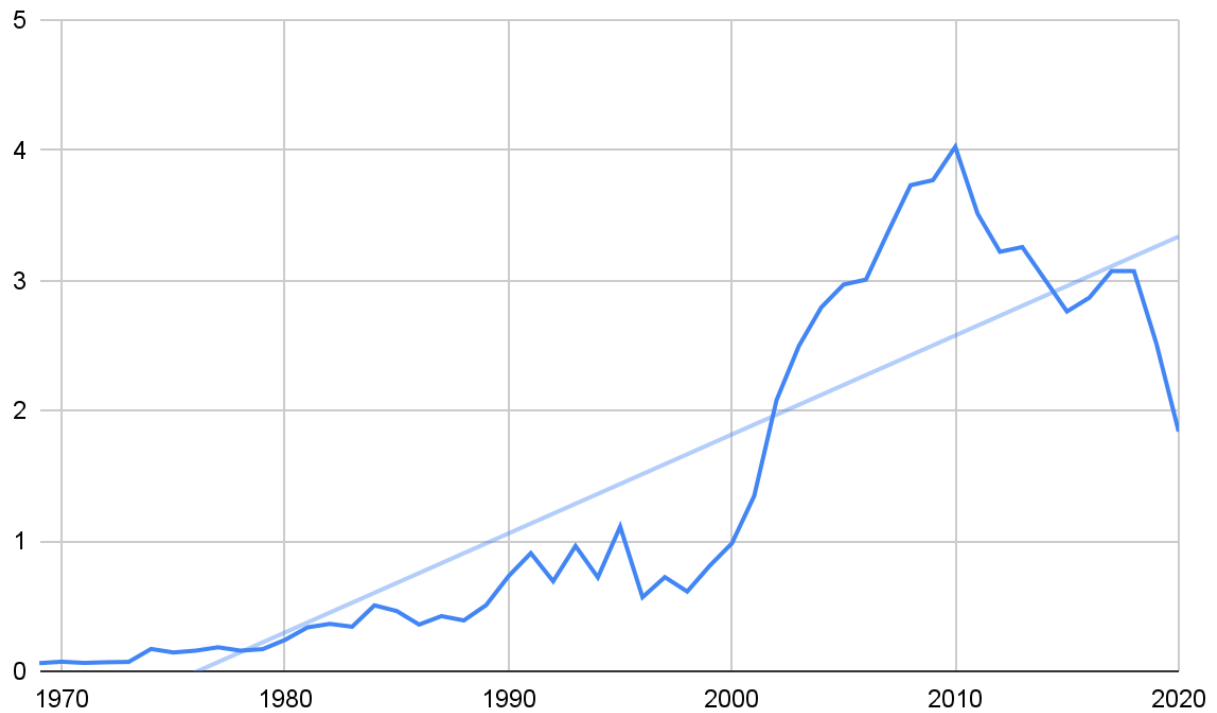


Figure 2

Average Article Citations per Year by Year Published ($R^2 = 0.78$)



Independent article features included the following six variables:

- Title Character Count: The number of characters (i.e., numbers, letters, or punctuation) in the article's title (see Table 2 for descriptives).
- Title Colon: Whether the title included a colon, thereby suggesting the presence of a subtitle (0 = no colon [n = 27,921] and 1 = colon present [n = 23,336]).
- Abstract Reading Difficulty: The Flesch-Kincaid Reading Ease score for the article's abstract (0 = very difficult to read and 100 = very easy to read; see Table 2 for descriptives).
- Abstract Reading Time: The predicted number of seconds needed for the average adult to read the abstract as calculated on a range from 150 words per minute for a Reading Ease score of 0 to 300 words per minute for a score of 100 (see Table 2 for descriptives).
- Abstract Word Count: The number of words in the abstract (see Table 2 for descriptives).
- Open Access: Whether the article was marked as released under an open access agreement (0 = non-open access [n = 44,663] and 1 = open access [n = 6,618]).

Table 2

Descriptives of Continuous Variables

	Mean	SD	Min	Max
Title Character Count	92.107	30.990	6	255
Abstract Reading Ease	24.349	13.551	0	100
Abstract Reading Speed	52.755	20.434	1	459
Abstract Word Count	161.918	60.874	4	1,289

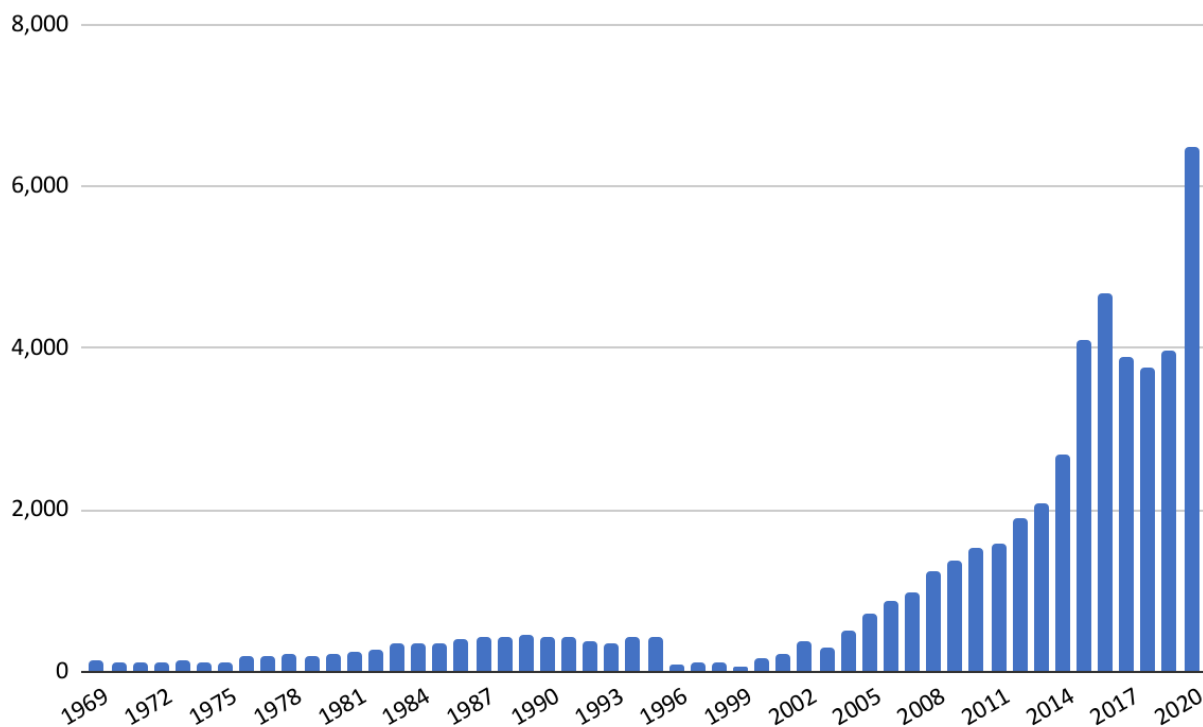
A year covariate was also included to better control for time-based effects on citation counts. Annual totals of articles revealed a general upward trend in article volume with a few notable exceptions between 1996 and 2003 (see Figure 3).

The increase in article volume overall was likely due to more journals releasing online versions over time since the early 2000s (and thereby increasing the number of articles that could be published without the cost prohibitions of a paper-based medium), but it was unclear to us why a dip occurred in 1996. Nonetheless, we did not expect these variations in volume to impact results in a meaningful way but used year as a covariate to ensure that historical or other anomalies in the data would be accounted for. Furthermore, our models were constructed using M+ software, which preferred for these values to be normalized to small integers for greater ease in interpreting Betas and other values (e.g., 2012 = 2.012).

And finally, recognizing (a) that journals that have been publishing longer were being cited more on average than younger journals and (b) that journals that have been publishing longer had a lower percentage of open access articles, we also used the longevity of the journal as an additional covariate for our analysis. This further helped to control for journal characteristics outside the control of individual article authors that might be influencing citation counts, such as the perceived prestige of the journal in the field.

Figure 3

Distribution of Included Articles by Year



Results

Results indicated overall significant (but weak) effects on both raw citations ($R^2 = 0.022$, $p < .01$; see Table 3) and citations per year ($R^2 = 0.054$, $p < .001$; see Table 4). For raw citations, the model showed that articles would be cited more if their authors (a) shortened the title, (b) made the abstract more technical, (c) lengthened the abstract, and (d) included a colon in the title. For citations per year, the model showed that articles would be cited more if their authors (a) made the abstract more technical and (b) included a colon in the title. Furthermore, the size of the dataset allowed us to detect significant effects that had relatively small effect sizes, so the fact that reading time and open access status did not affect either result is also noteworthy.

Table 3

Article Feature Effects on Raw Citations

	Estimate	S.E.	Est./S.E.	Two-Tailed <i>p</i> Value
Model R-Square	0.022	0.008	2.624	0.009**
Title Character Count	-0.044	0.012	-3.71	0.000***
Title Colon	0.039	0.009	4.414	0.000***
Abstract Reading Ease	-0.117	0.02	-5.898	0.000***
Abstract Reading Time	-0.12	0.056	-2.15	0.032
Abstract Word Count	0.152	0.051	2.987	0.003**
Open Access	-0.023	0.018	-1.262	0.207
Year Covariate	-0.056	0.041	-1.373	0.17
Journal Longevity	0.075	0.039	1.926	0.054

Table 4

Article Feature Effects on Citations per Year

	Estimate	S.E.	Est./S.E.	Two-Tailed <i>p</i> Value
Model R-Square	0.054	0.013	4.079	0.000***
Title Character Count	-0.023	0.013	-1.802	0.071
Title Colon	0.045	0.008	5.813	0.000***
Abstract Reading Ease	-0.062	0.02	-3.026	0.002**
Abstract Reading Time	0.027	0.061	0.447	0.655
Abstract Word Count	0.03	0.056	0.54	0.589
Open Access	0.001	0.021	0.051	0.959
Year Covariate	0.175	0.024	7.375	0.000***
Journal Longevity	0.164	0.048	3.41	0.001**

Discussion

Titles

Shorter titles were more likely to be cited than longer titles, but the inclusion of a colon (typically used in longer titles) also had a positive effect. This suggests to us that when writing titles, subtitles can be useful for improving citations but that authors should practice parsimony in the length of both the title and the subtitle. For articles without a colon in the title, there seems to be a Goldilocks zone of between 30 and 50 characters or 5 to 9 words for optimal length (see Figure 4). For articles with a colon, the Goldilocks zone appears to be slightly higher, between 40 and 70 characters or 7 to 12 words (see Figure 5).

Figure 4

Distribution of Average Citations by Title Length for Articles without Colons

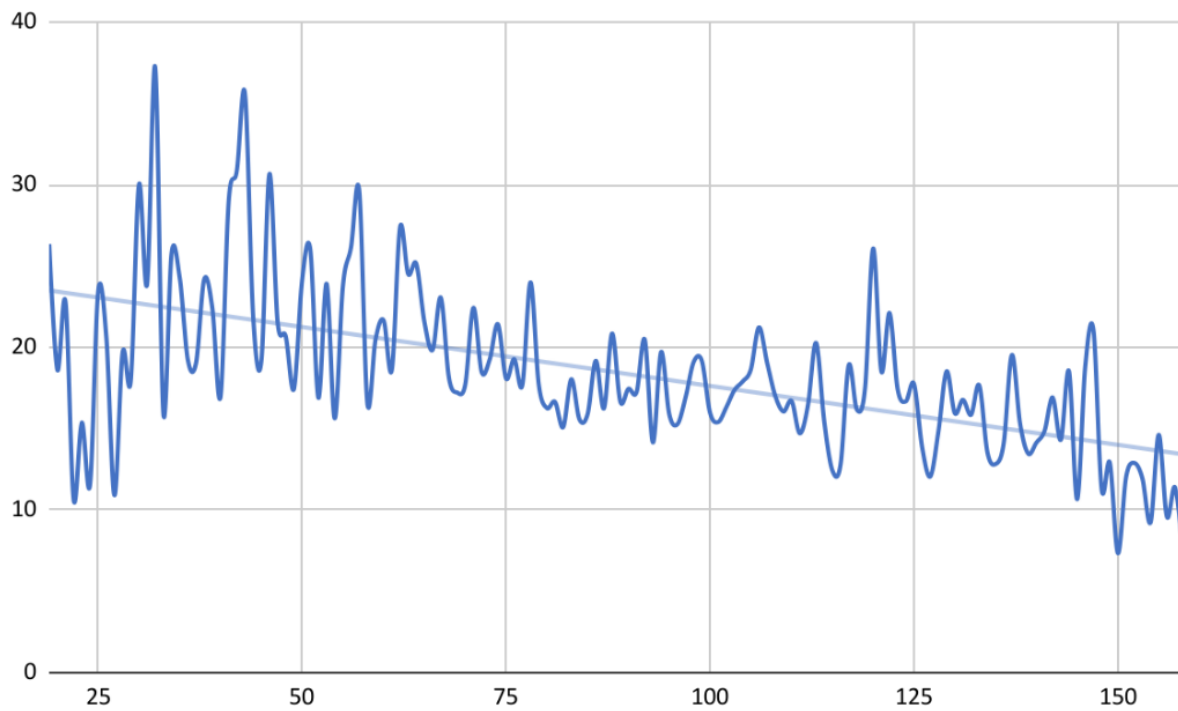
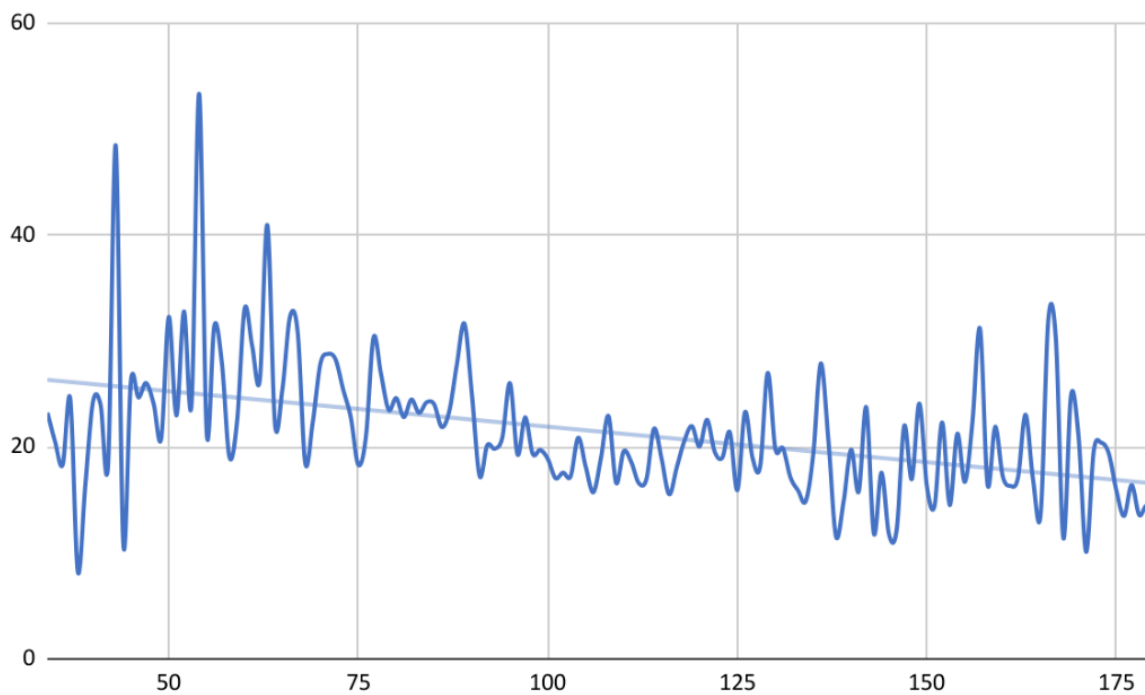


Figure 5
Distribution of Average Citations by Title Length for Articles with Colons



Abstracts

Contrary to our assumption, reading ease had a negative effect on citations. This was surprising because we assumed that if an abstract was more readable and less esoteric that people would be more likely to cite it. The opposite result, however, suggests that more technical abstracts yield greater citations. This might be the result of greater specificity provided in abstracts, or it might be due to certain topics or methodologies that rely upon long words with many syllables being cited more often, such as studies that rely upon advanced statistical procedures like “hierarchical linear modeling.” It could also mean that articles are often cited based on the content of their abstracts and that leaner abstracts do not provide other authors with enough information to warrant a citation. We do not take this result to mean that authors should attempt to make their abstracts intentionally difficult to decipher, but it does suggest that including technical language and detail in abstracts might be beneficial. Couple this with the positive effect that abstract length had on raw citations and the lack of effect that reading time had on citations, and the takeaway seems to be that more detail in abstracts is a good thing.

Open Access

Contrary to previous studies seeking to understand open access effects on citation counts, we did not detect an open access bump. At least two possible explanations exist for this discrepancy: time and context. Regarding time, many studies exploring the open access topic have restricted their analyses to relatively short timeframes, suggesting that there may be an initial open-access bump to citations but that this advantage might fade over time. In addition, the context of most studies in this realm has focused on the natural sciences, and it may be that education or the social sciences more broadly exhibit different citation patterns than other fields.

Conclusion

Results from our analysis reveal that some education research article features have significant (though relatively small) effects on citation counts. Notably, articles are most likely to be cited if (a) their titles include a semi-colon-designated subtitle, (b) their titles are 7 to 12 words in length, (c) their abstracts are longer, and (d) their abstracts include technical language.

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Teaching and Teacher Education

A History of Research Trends from 1970 to 2020

Hillari Bollard, Meagan Nielsen, Layne West, Devin Young, Julie Irvine, & Royce Kimmons

By undertaking a comprehensive analysis of the top cited research articles in teaching and teacher education over the past 50 years, this chapter identifies trends and issues in this field leading up to and including the year 2020. Data sources included articles from thirteen professional journals on teaching and teacher education. We identified the 20 top cited articles of each decade from 1970 to 2020, resulting in 120 articles comprised of empirical studies, theoretical works, literature reviews, and conceptual papers. Then, we analyzed each article individually for content and compared the articles to identify key themes throughout the decades. Results show that broad changes took place in the field of teaching and teacher education over the past 50 years. We observed the following trends: (a) increased focus on teacher education improvement and reform, including a move from focusing on teacher practice within teacher education programs toward a focus on teacher beliefs, efficacy, and attrition; (b) increased awareness of sociocultural factors within teaching and teacher education; and (c) increased acknowledgment of the unique needs of ESL students, which was reflected by changes in the field of ESL teaching. The implications of this analysis are that as teaching and teacher education evolves, and as researchers and practitioners seek for ways to further improve the field, teaching and teacher education will continue to move toward more student-centered, culturally-aware approaches.

In this chapter, we analyze top cited research in teaching and teacher education from 1970 to 2020 in order to identify prominent themes, ideas, and methodologies. This analysis will discuss these themes, the contexts in which they were considered, and the methodologies used in the research from these articles to identify similarities and differences, overlap of content, and emerging trends. In doing so, we hope to understand the trends and issues in teaching and teacher education and to identify ways to use what has been learned over the past 50 years to enhance the future of teaching and teacher education.

Many studies, research projects, and special editions of journals or magazines have synthesized teaching and teacher education research. These efforts to synthesize previous research can be classified into two approaches, namely topic-

specific summaries and journal-specific syntheses. For example, in a topic-specific summary, Hallinger and Kulophas (2020) summarized research on leadership and professional learning in K–12 schools by conducting a bibliometric analysis. Ro (2019) focused specifically on novice teachers' professional learning in varied test-based accountability contexts by reviewing all relevant articles published in one specific journal. Although these and other examples cited below are comprehensive in their analysis of one specific topic or topics within one specific publication, to date, there has not been an analysis conducted with the intent to synthesize the literature across topics and journals surrounding teaching and teacher education within the past 50 years. Nor has there been any such review presented in which an overview of the themes or a narrative of the areas of interest in this dynamic field have been provided.

We conducted a brief meta-analysis of literature that aimed to review comparable research in teaching and teacher education. This endeavor revealed that most synthesis articles to date have focused on either a particular issue or limited time period. For example, Küçükaydin (2019) conducted a meta-synthesis that specifically addressed themes and codes of pedagogical content knowledge studies in science education. Zuga (1994) reviewed and synthesized literature published from 1987 to 1993 on K–12 teacher education in technology education. Many articles focused on a range of specific issues, including the role of international experiential learning in the multidimensional development of pre- and in-service language teachers (Çiftçi & Karaman, 2019), the impact professional learning communities have on teaching practices and student learning (Vescio et al., 2008), and the impact of language instruction (Long, 1983). While these examples provide information about specific topics, readers are not able to contextualize the relevant significance of these topics in the greater landscape of issues relating to teaching and teacher education.

In another approach to summarizing the literature, researchers conducted several syntheses encompassing articles from within one specific journal. For example, Livingston and Flores (2017) analyzed research and provided a summary of the major themes published only in the *European Journal of Teacher Education* since its first publication in 1978. In another review, Cottle et al. (2012) examined the *Journal of Technology and Teacher Education* to summarize trends and topics published during the time period from 2001 to 2010. And lastly, Rock et al. (2016) provided a summary of studies published in two journals: *Teacher Education and Special Education* and the *Journal of Teacher Education* from 1996 to 2014. Reviews of this type can provide insight into the publishing priorities of specific major journals in the field of education and may reflect the changing interests of researchers and practitioners. Yet this approach may fail to capture significant trends that were not in line with the publishing priorities of these specific journals, resulting in biases favoring the limited scope and aim of the target journal. In contrast, our research synthesized and analyzed articles from multiple journals and was not limited to specific themes or topics.

Our research adds to the findings from other research in making connections with the contexts of political, social, and educational changes (Crook, 2012). Our unique methodology has given us insight into teaching and teacher education themes from 1970–2020. The articles we analyzed used different methodologies, including empirical, theoretical, conceptual, and literature reviews. This diverse collection of articles added to our synthesis of themes that emerged in teaching and teacher education. Because our methodology was unlike any other used previously, the results contained herein provide a unique review of the evolution of teaching and teacher education over the last 50 years.

1970s: Student Teaching and Teacher Education, Student Achievement, and Teacher Effectiveness and Evaluation

The top 20 most cited articles from the 1970s in teaching and teacher education represented many topics and themes. This analysis will discuss the most common themes of student teaching and teacher education, student achievement, and teacher effectiveness and evaluation. We will also consider trends from the decade and common types of research used.

Research Methods

Among the 1970s top 20 most cited research articles, there were three main types of research: empirical studies, literature reviews, and theoretical papers. Of the 20 articles, about 50% were empirical research, 25% were literature

reviews, and the remaining 25% were theoretical papers. Even though theoretical papers were the least represented, two of the top five most cited articles were theoretical papers, including the most cited article, which focused on why and how to ask questions in the classroom that have a specific known answer (Mehan, 1979).

Themes

The dataset was drawn from many prominent journals. Most of the top cited articles were published in one of three journals. The most popular journal, which published almost half of these articles, was the *Journal of Teacher Education*. The rest of the articles were split between the *Journal of Educational Research* and *Theory Into Practice*, with one article published in the *English Language Teaching Journal*.

The top 20 articles from the 1970s covered many topics, including student teaching and teacher education, teaching strategies, various forms of student achievement, teacher effectiveness and evaluation, people who influence teachers, and student-faculty relationships. The three most popular topics were student teaching and teacher education (five articles), teacher effectiveness and evaluation (five articles), and student achievement (three articles).

Even though these were some of the most common topics, the top three articles of the decade each covered unique topics not touched on in other articles. The most cited article focused on asking known questions in the classroom (Mehan, 1979), the second focused on morals and how or if they should be taught in the classroom (Kohlberg & Hersh, 1977), and the third focused on the adoption of new innovations (Hall et al., 1975).

Student Teaching and Teacher Education

Twenty-five percent of the most cited articles from the 1970s focused on student teaching and teacher education. Of those articles, each took a slightly different perspective of an aspect of student teaching or teacher education. Doyle's (1979) article focused on discovering what factors impact student teachers as they start teaching in the classroom. He asserted that understanding the classroom environment first was essential for student teachers to develop the skills needed to meet the demands of the class. Once student teachers understood the complexities within their classrooms, they could use Doyle's five strategies to successfully adapt to their students' needs—chunking, differentiation, overlap, timing, and rapid judgement (p. 54). Doyle's research was influential because it identified key skills teachers learn over the course of their careers and discussed how student teachers can implement those skills when they are introduced into a classroom.

Two other articles on influences in student teaching were published in the 1970s. Hoy and Reese (1977) studied how student teachers changed in their orientations and outlooks over the course of student teaching, finding that student teachers were heavily influenced by the bureaucratic organization of the schools they taught in. In contrast, Karmos and Jacko (1977) researched the effect that significant others have on student teachers. Their findings suggested the significant others in student teachers' lives had a considerable influence in the following areas: personal support, role development, and professional skills. Both studies provided insight into the external factors that impact student teachers' self-concept.

Another article from the 1970s that focused on teacher education was Shavelson's (1973) article on decision-making, teaching skills, and teacher education. Shavelson studied how licensed teachers make decisions, including those in preservice teacher education, and he proposed decision-making was the skill all other teacher skills were based on. He also suggested decision-making be included as a component in teacher education (p. 149). Shavelson's work, along with many of the other articles from the 1970s, sought to understand the aspects that influence student teachers and teacher education. These researchers laid the groundwork for improving teacher education in later decades.

Student Achievement

Student achievement was also a common topic in the research. Good (1979) wrote an article that considered what impact teacher effectiveness had on student achievement. He found that teachers needed to have a minimum level of ability and teaching skill to be effective in the classroom, but all teachers did have an impact on student achievement. Teachers who had good classroom management skills had a higher positive effect on student achievement, and

teachers who used direct instruction also had a positive impact on student achievement. Good's research showed the influence teachers have on student achievement. His conclusions supported other findings from the 1970s that identified gaps in teacher education and advocated for improvements to teachers' training.

Other articles from the 1970s focused on students' behavior in relation to their academic achievement. These studies researched math achievement between boys and girls (Hilton & Berglund, 1974) and note-taking by college students (Locke, 1977). Hilton and Berglund concluded that student interest in a subject was related to achievement, while Locke reported lecture engagement was related to achievement. Both articles emphasized students' individual responsibilities, rather than teachers' responsibilities, for their education. This research supported other studies from the decade that sought to understand the factors involved in students' academic success.

Teacher Effectiveness and Evaluation

As mentioned above, one article by Good focused on the impact of teacher effectiveness on student achievement. But there was also an article by Good and Grouws (1977) that discussed different skills teachers should have that can increase their effectiveness. The researchers studied fourth-grade math teachers to examine teacher effectiveness measured by student behavior and test scores. This study identified six findings strongly associated with teacher effectiveness: (a) student-initiated behavior, (b) whole class instruction, (c) clear instructions coupled with timely feedback, (d) a relaxed yet task-focused learning environment, (e) high expectations for student performance, and (f) an absence of major behavioral disorders in the class. Good and Grouws's research highlighted changes teachers could make in their classrooms to benefit students.

In contrast, Berliner (1976) focused on the problems with teacher evaluation practices during the 1970s. He discussed flaws with the ways teachers were being evaluated, and he proposed six main issues with teacher evaluation methods. Those issues were broken up into problems with the dependent variables and independent variables. Dependent variable issues included problems with standardized testing, tests for special teaching units, and multivariate outcomes. Independent variable issues included the appropriateness of teacher behavior (changes when observers are there), the unit analysis, and the stability of teacher behavior. Berliner suggested steps researchers could take to solve the problems undergirding teacher evaluation and effectiveness, as well as what needed to happen in education research to redefine the relationship between teacher behavior and student achievement.

Discussion

This analysis shows that the 1970s witnessed an emphasis on student teaching and teacher education research. Researchers studied what made effective student teachers (Doyle, 1979), how licensed teachers were teaching and planning (Shavelson, 1973; Yinger, 1979) and how to incorporate that research into preservice teacher education programs. There was equal focus on student achievement and teacher effectiveness.

1980s: ESL, Changes in Teacher Education, Teacher Efficacy, and Teaching Methodology

An analysis of the most frequently cited articles on teaching and teacher education written in the 1980s yields a range of topics, ideas, and methodologies. Out of the 20 articles, 11 researched English as a second language (ESL) teaching methods and theory. The theme of teacher education comprised five articles and centered mainly on change and reform within the university setting. Three articles were concerned with teacher efficacy, and one article dealt with a specific teaching methodology called "wait time," although teaching methodology was also a secondary topic found in the ESL articles.

Research Methods

Methods used for research during this time period fell into three categories: (a) empirical studies, which included quantitative, qualitative, and mixed method studies; (b) literature reviews in which a review of previously completed

studies was analyzed for content and implications; and (c) theoretical analyses, or papers which discussed a topic and the theory supporting or refuting it. Of the 20 studies, 11 were empirical, five were literature reviews, and four were theoretical. The emphasis on empirical studies, particularly within the theme of ESL, suggests a strong push to understand which practices best met the needs of English language learners (ELLs) at the time. It also shows that a change was occurring in the ESL environment during the 1980s. These empirical studies utilized a variety of quantitative and qualitative methods. Some studies consisted of large groups of ELLs, and some consisted of small sample sizes. Procedures included questionnaires, surveys, interviews, observations, recordings, and studies of ELL writing samples. This emphasis on ESL empirical studies carries over into the literature review studies, three of which consisted of analyses of empirical studies devoted to second language acquisition. The four theoretical studies, on the other hand, focused primarily on teacher education.

Themes

English as a Second Language

Interestingly, the topic of English as a second language, second language acquisition, or second language (L2) teaching strategies comprised over 50% of the top cited articles from the 1980s and over 20% of the total number of articles analyzed for this chapter. This could be due to what the United States Census Bureau terms the "Second Great Wave" of immigration (Greico, 2014). According to census data, the number of foreign-born residents of the United States quadrupled after 1970, and the number continued to climb for the next four decades. Educators in the 1980s responded to students' need for ESL instruction by utilizing a variety of methods in the classroom, and educational researchers worked to identify the best methods for this instruction. It is clear that the ability to effectively teach second language learners was foremost in the minds of education researchers. The following is a discussion of each of the topics within the theme of ESL.

A variety of ESL teaching methods were discussed including language instruction, group work, and student-teacher interaction. Long (1983) reviewed 12 studies to determine whether or not classroom instruction, as opposed to simple exposure to the language as spoken by native speakers, was actually helpful or harmful in second language acquisition. He concluded that second language instruction does make a difference, noting that six of the 12 studies showed that instruction did make a difference. Five studies provided either ambiguous or null findings, and Long argued those results could have reflected the efficacy of instruction. The final study was disregarded by the researcher because all subjects received the same amount of instruction. Long and Porter (1985) tackled the idea of group work in second language acquisition by analyzing the pedagogical and psycholinguistic evidence of the value of group work as methodology. Their focus was on comprehensible input and output that occurs with both nonnative/nonnative and native/nonnative conversation. This study focused on "interlanguage talk" or communication between two or more nonnative speakers in the second language. Results indicated that when class structure was carefully planned, group activity was a preferable alternative to teacher-led discussion. Methods of student-teacher interaction were further explored by Pica et al. (1987) as they compared the comprehension of native speakers when given a task by a teacher. They found that comprehension was highest when the direction was repeated and rephrased but was not significantly impacted when the linguistic complexity was reduced. These studies indicated that educators in the 1980s were highly interested in determining effective teaching methodology for second language acquisition.

The nature of the composition process and the impact of educator feedback on student writing was of interest to educational researchers in the 1980s. Zamel (1985) and Robb et al. (1986) analyzed the impact of error correction on ELLs. Robb et al. found that ESL teachers focused predominantly on mechanical errors in writing, whereas teachers of other subjects focused on content and argumentation. Zamel's findings were similar, noting that ESL teachers focused on "language-specific" or "sentence level" errors. Both studies explained that ESL composition teachers rarely viewed ESL students' writing as a "work in progress," instead giving feedback as if the draft was the final composition, "thus reinforcing an extremely constricted notion of composing" (Zamel, p. 79). This built upon Zamel's previous research on the composing processes of ESL students in which she found that ESL writers clarify ideas and correct language-related errors after their ideas have been delineated (1983). She questioned methodology in ESL writing instruction that

was overly concerned with correctness. This work provided a closer look into how previously accepted methodologies surrounding second language instruction were being questioned.

In addition to methodology, the age at which a student first began studying a second language and the length of time they engaged in the study were also of importance to education researchers in the 1980s. Some questions in this vein included the following: "How long does it take to master a language?", "Is it easier for young children to acquire a second language?", and "How long does it take to master the language at a level of proficiency to positively impact academic achievement?" (Collier, 1987, 1989). Collier's findings indicated that contrary to popular thought, the youngest students were not at an advantage when compared to their older peers. Her results in a study of over 1,500 students indicated that limited English proficient (LEP) students who began L2 study between the ages of 8–11 were the fastest achievers, requiring two to five years to achieve the 50th percentile on national tests (Collier, 1989). Younger students (5–7 years) were one to three years behind this performance, and older students (12–15 years) were the most disadvantaged. Taken in concert with other studies regarding teaching methods, the understanding of how a student's age and length of study impacted success at acquiring a second language gave significant insight in how best to help ELL students be successful in acquiring a second language and performing in other academic areas.

In contrast to previous research in the decade, one highly cited theoretical article from the time argued that the positivist and progressive orthodoxies of linguistics should be challenged (Pennycook, 1989). This research asserted that the primary focus on methods maintained inequities in the education realm. This is a noteworthy digression from the abundance of discussion on ESL teaching methodology. This article was published at the end of the decade and was a precursor for more interest in this topic in the 1990s.

Changes in Teacher Education

During the 1980s, seeds of doubt regarding traditional training methods for teachers were beginning to sprout. Two articles focused on theory and literature advocating reforms. Zeichner (1983) argued that there was a lack of open debate over the goals and purposes of teacher education and that the models of teacher education utilized during that time were narrow in scope and closely tied to dominant paradigms. He advocated for discussing desirable teacher education practices and proposed a range of alternative paradigms from which to approach teacher education. This furthered the research started at the beginning of the decade when Zeichner and Tabachnik (1981) posed questions surrounding why progressive ideologies presented to teacher education students at the university level were then "washed out" by the time student teachers and new teachers began to practice at the school level. By analyzing three views on the influence of the university on teacher attitudes, the conclusion the authors made was that new teachers were not only influenced by the school setting but also by the years of teaching examples they received prior to entering a university-level teacher education program. They concluded that it could not be assumed that the role of a university was a liberalizing one. The implications were that teacher education reformers needed to focus more on the university setting rather than on the school setting.

In 1989, the idea of reflective teaching was emerging as an important aspect of teacher education reform. Calderhead (1989) urged further examination on teacher cognitions, knowledge, and learning context in order to understand the role that reflective teaching had on teacher education. During this time, ideas encompassed within reflective teaching such as growth through critical inquiry, self-directed evaluation, and self-analysis were being compared with widely used teacher education content such as behavioral skills and teacher craft. Calderhead's work was a call to action to develop an improved understanding of the nature of reflection and its potential in teacher education.

In addition to Calderhead's findings, a study analyzing the results of questionnaires given to 113 university education majors regarding their own preconceptions of teaching and what makes a "good teacher" gave a broad understanding of how those approaching teaching as a profession viewed themselves and teaching in general (Weinstein, 1989). Findings from this study indicated that education students had a strong form of "optimism bias" in which they viewed themselves as very competent compared to peers and other educators. Their answers indicated that they did not highly value content knowledge, academic performance, or IQ as a standard of good teaching but instead leaned favorably toward social and affective variables such as caring and concern for children, ability to relate to students, patience, and

enthusiasm. The responses of teacher education students were compared to those of in-service teachers, with nearly opposing results. This study would have had direct implications on the movement to reform teacher education in favor of more reflective teaching and more culturally aware teaching that would later grow in the 1990s.

Although mentoring is not specific only to teacher education, the idea of mentoring did appear toward the end of the decade. Anderson and Shannon (1988) discussed mentoring as a way to guide new teachers. Their research indicated that before effective mentoring programs could be implemented, basic functions of mentoring must be defined. Their research focused on five main areas: teach, sponsor, encourage, counsel, and befriend. A thorough analysis of theory behind mentoring and the disposition of mentors was also provided. The inclusion of mentoring as a methodology in teacher education supports the idea that new ideas on how to improve teacher education were being explored.

Teacher Efficacy

Three articles discussed teacher efficacy, or the concept of a teacher's belief in their own ability to be successful in the classroom. These articles focused on the idea that teacher efficacy had an impact on whether or not a new innovation could be successfully implemented in a school. Stein and Wang (1988) analyzed the relationship between teacher success in implementing an innovative program and teachers' perceptions of self-efficacy and the teacher-perceived value of the program. They found that teachers' self-efficacy contributed to the motivation of teachers to implement a new program. Guskey (1988) also found a strong relationship between teachers who exhibited a high level of personal efficacy and the likelihood of implementation of new instructional strategies. Both of these studies addressed implications on school change and innovation in teaching. These studies would most likely have influenced those who sought to change teacher education programs or in-service practice.

Teacher content knowledge and its impact on a teacher's self-efficacy was another topic of interest. Smith and Neale (1989) analyzed the views and behaviors of 10 teachers during a four-week summer school training on implementing a new science curriculum which utilized a conceptual change approach. Recognizing that the approach was new, the authors (also the designers of the curriculum) wanted to ensure that it would be successfully taught. This study provided a good example of how teacher efficacy affected new curriculum implementation. Throughout the four-week summer school training, teachers were provided opportunities to understand the new program and the content. After the training was completed, teachers expressed their confidence in their ability to implement the program. This was in contrast to the start of the training when 90% of the teachers expressed that they did not have confidence in their content knowledge and therefore did not believe they could successfully implement the program. Although self-efficacy was not a direct measure of the study, this study did indicate that self-efficacy had a direct impact on whether or not teachers successfully implemented innovative programs.

Teaching Methodology

Researchers approached teaching methodology in a variety of ways throughout the decade. Because there was such a focus on ESL, many of the articles on teaching methodology were found within the ESL articles and dealt primarily with the best ways to help ELLs become proficient in English. However, one frequently cited article dealt with wait time, or the amount of time a teacher would wait after posing questions to students or the amount of time a teacher would allow between student responses without interjecting (Rowe, 1986). This literature review documented research on the impact of wait time on student engagement and response in the classroom. The author concluded that when wait time was increased, a variety of positive student behaviors were observed.

Discussion

The 1980s were a precursor to a variety of changes in teaching and teacher education that occurred during the 1990s. Education researchers were intent on finding the best way to help English language learners succeed academically, but there was not yet a focus on how to do this and maintain a respect for a student's primary language, culture, and ethnicity. Teacher education researchers were looking for ways to reform teacher education. Ideas in teacher efficacy, reflective teaching, and mentoring were also being explored.

1990s: Language Learning, Home and Culture, and Education Improvement

In a review of the 20 top cited articles related to teaching and teacher education from the 1990s, a variety of research methodologies were represented, and a few clear and distinct themes were present. In many ways, the themes coincided with those from the 1980s. For example, in the 1980s, the majority of articles focused on ESL teaching and theories. That trend continued in the 1990s, where seven of the 20 articles focused on language learning. Likewise, there seems to have been a continuous effort during the 1980s and 1990s to examine teacher education where many suggestions for improvement emerged. In both the 1980s and 1990s, there was an increase in female and international authors compared to the 1970s. Two very noticeable thematic departures from previous decades that were specifically noted in the 1990s included a focus on race and ethnicity and home and community as determinants of teaching and teacher education.

Research Methods

In the 1990s, various research methodologies were used in the top cited articles that can be categorized into four types: empirical studies, literature reviews, theoretical or reflective papers, and conceptual pieces. The majority of the articles were empirical (11 of 20) and used quantitative, qualitative, and mixed methods, with most being qualitative. Eight articles were either conceptual (synthesizing knowledge from previous research and giving way for new research to fill the knowledge gaps) or theoretical (offering suggestions or solutions to educational dilemmas or challenges). Only one of the articles was a literature review.

Themes

We identified three prominent themes from the top cited articles in the 1990s: language learning, the impact of socioeconomic status (SES) on student learning, and general strategies to improve teacher education.

Language Learning

In the top cited articles of the 1990s, language learning was one of the major themes in over one third of the articles. There were different points of focus in each article. For example, Peirce (1995) collected data from immigrant women to use in conjunction with knowledge of social theory to argue that current conceptions of the individual in second language acquisition (SLA) needed to be reconceptualized. Freeman and Johnson (1998) explored the idea that historical and theoretical traditions had defined TESOL and examined the need to reconceptualize the knowledge base of teacher education. Another article discussed common attitudes toward language and explored the need to have a positive image of second language users (Cook, 1999). Finally, another examined the influence of social order on English language teaching (ELT) practitioners' decisions in the classroom and how those decisions shaped attitudes, assumptions, and beliefs in learners and language planning and policy (Ricento & Hornberger, 1996).

In several language learning articles, there seemed to be a link between culture and language learning. Green and Oxford (1995) called for further research about the specific patterns of language learning strategies found in Puerto Rico that could be generalized to other geographical and cultural settings. Silva (1993) discussed a need to develop theories and practices that adequately address the multilingual and multicultural perspective of L2 writers (Silva, 1993). In addition, Rampton (1990) analyzed the complications of sociolinguistic situations and examined the links between people and language and the need to use more culturally appropriate terms.

Home and Culture

A second theme that emerged was the impact and influence of socioeconomic factors such as race, culture, and family structure on teaching and teacher education. In a study of Mexican communities in Arizona, the primary purpose was to draw upon the knowledge and skills found in local households. Moll et al. (1992) suggested that some students' households that are usually viewed as poor actually contain ample cultural and cognitive resources with potential utility

for classroom instruction. By capitalizing on household and other community resources, educators could organize classroom instruction that far exceeds the quality of instruction these children commonly encounter in schools.

In another article, Caldas and Bankston (1997) explored how the socioeconomic status of a student's peer environment at school influenced achievement, regardless of individual social status. Later in the decade, Desimone (1999) found how the effects of parental involvement in childrens' learning vary across racial, ethnic, and economic backgrounds to help bridge the gap in educational disparities. Ladson-Billings (1995) discussed the need to understand better the practice of successful teachers of African American and other minority students.

Education Improvement

A third theme focused on general strategies to improve or reconceptualize different teaching and teacher education components. For example, it was suggested that teachers continue to value professional teacher preparation while training on the reflective process and gaining practical knowledge and insight (Van Manen, 1995). Also, classroom instruction could be organized more effectively by taking advantage of household and community resources in innovative ways (Moll, 1992). Calderhead and Robison (1991) found that a student teacher's previous knowledge impacted their teacher education experience by influencing what they learned and what they extracted from their courses and training. They suggested that continual research in this area could improve students' training and education by enlarging their current understanding with more profitable and constructive training for student teachers. Other strategies to improve teaching and teacher education focused on recognizing the emotional labor required in teaching, including emotions associated with educational reform, because teaching cannot be reduced to technical competence or clinical standards (Hargreaves 1998). These strategies for education improvement laid the groundwork for continuing research in following decades.

Outlier

There was one study from the 1990s on bullying. Although it is not easily categorized into one of the major themes of the 1990s, it is important to recognize this article given how an emphasis in research on bullying increased in subsequent years. The study results found that bullying occurred twice every hour in each classroom. In addition, boys and girls were bullied at the same rate. It also suggested that bullying could be related to classroom activity and individual characteristics of children involved in the bullying (Atlas & Pepler, 1998). This topic, while unique among the other top cited articles of the decade, is useful in understanding the various influences in education research during the 1990s.

Discussion

Research in the 1990s shifted toward students' experiences in the classroom. The main themes of language learning, home and culture, and teacher education improvement had a strong emphasis on improving instruction and education for learners. These themes continued into the 2000s, including an increased focus on teacher improvement.

2000s: High-Quality Teacher Education, Professional Identity, and Teacher Change

The top cited articles from the 2000s continued to emphasize major themes in the field of teacher education research. The research themes from this decade focused on identifying challenges teachers face and providing solutions to those challenges. These articles emphasized research that aimed to improve teachers' education and professional experiences, which was a trend that extended into the following decades.

Research Methods

During the 2000s, a shift occurred in research methods used in the top cited articles. The previous three decades were heavily influenced by empirical studies, as the majority of the top cited articles in each decade fell within this methodology. However, the majority of the articles during the 2000s were theoretical studies: 12 were theoretical, 3

were empirical, 3 were literature reviews, and 2 were conceptual. The following themes show much of what was discussed in the theoretical studies.

Themes

Three main themes emerged from the 20 top cited articles in this decade. The most prominent theme was high-quality teacher education. The articles in this category emphasized maintaining quality in teacher education. The second theme was professional identity, which focused mostly on novice teachers and how their professional identity was created. And the third major theme was teacher change, which sought to create models that tracked teacher improvement over time. Each of these themes is described in more detail below.

High-Quality Teacher Education

Seven of the 20 articles had topics related to maintaining high-quality teacher education. Darling-Hammond addressed the issue directly with her article about constructing 21st-century teacher education (2006). In the introduction to the article, she stated that much of what made a teacher successful was invisible to the common observer, leading the common observer (or policymaker) to think that teaching was easy. She warned of the dangers of this type of thinking, stating that watering down teacher education to get more teachers in the profession will ultimately have a negative impact on student outcomes. Darling-Hammond pointed to incentives from the U.S. Department of Education that amplified the problem by encouraging faster, easier ways to credential teachers. These incentives ignored the complexities of teaching and produced weak programs that underprepared teachers, especially for urban school environments.

Other articles in this category attempted to define a good teacher through different lenses and then suggested models to help identify training that would create good teachers (e.g., Korthagen, 2004; Loewenberg Ball & Forzani, 2009; Grossman et al., 2009). Loewenberg Ball and Forzani (2009) echoed the words of Darling-Hammond when they stated that teaching is not natural and that it is intricate work. They stated that teaching is not improvisational but instead a series of skills that could be identified and practiced.

One last note in this category is that the first two studies in the decade had a subtheme of preparing teachers for culturally aware teaching (Gay, 2002; Sleeter, 2001), but the next five studies were more general in discussing teaching as a whole. This will be explored further in the discussion portion of this decade.

Professional Identity

Another theme that emerged between 2004 and 2007 was the theme of professional identity. Beijaard et al.'s (2004) study was the first of the top cited articles to address this theme. Their article was a literature review of studies from 1988–2000 that explored professional identity. The authors analyzed 22 studies and categorized them into three areas: (a) studies in which the focus was on the formation of the teachers' professional identity, (b) studies in which the focus was on the identification of characteristics of teachers' professional identity, and (c) studies in which stories depicted the teachers' professional identity. The final part of this study identified areas that can be improved in further studies of teachers' professional identity. Some of these areas include clarifying terms such as "identity" and "self," ensuring the focus is on professional identity and not on personal identity, and clarifying what counts as professional.

The other studies in this category researched novice teachers and the development of their professional identities. Flores and Day (2006) discussed how identities are built and rebuilt over the first two years of a teacher's career. Fourteen brand new teachers were chosen for the qualitative study to find what was shaping their professional identity. The results of the study showed three main influences on the construction, deconstruction, and reconstruction of their professional identities: prior influences, initial teacher training and teaching practice, and contexts of teaching.

A third study in this category tried to identify sources of self-efficacy beliefs from both novice and experienced teachers (Tschannen-Moran & Hoy, 2007). The researchers studied survey data and found that experienced teachers drew upon experiences of success for their self-efficacy beliefs, while novice teachers drew upon availability of resources and support from other teachers.

Teacher Change

The final category for the 2000s was teacher change. Guskey's (2002) article provided support for a method of professional development that was first suggested in 1986. The method was based on the order in which teachers adopted three main components: professional practices, beliefs, and understanding of teachers. Guskey explained that professional development was often based around getting teachers to try a new method before they actually "bought in" to the new method. However, getting teachers to believe in the effectiveness of a new method before they tried it in their classrooms was more effective. Another article on teacher change was published by Korthagen (2004). He proposed six levels of change that should be considered in education. The six levels were environment, behavior, competencies, beliefs, identity, and mission. He suggested that if teachers were aware of these levels and sought to fulfill them for themselves, then they would also help their students do the same.

Discussion

The major takeaway from this decade is that many of the most cited articles of the 2000s dealt with maintaining the integrity of the teaching profession. While most articles did not cite specific reasons for focusing on the integrity of the teaching profession, Darling-Hammond (2006) pointed to the U.S. Department of Education's No Child Left Behind and Highly Qualified Teachers initiatives as reasons of the topic:

However, in recent years, under pressure from opponents of teacher education and with incentives for faster, cheaper alternatives (see, e.g., U.S. Department of Education, 2002), teacher education as an enterprise has probably launched more new weak programs that underprepare teachers, especially for urban schools, than it has further developed the stronger models that demonstrate what intense preparation can accomplish. As a result, beginning teacher attrition has continued to increase (p. 302).

Many in the profession felt the need to defend themselves and to raise awareness of the complexities of teaching. There was concern that if the quality of teaching decreased, achievement gaps would increase between urban schools and other areas. This seemed to be the most significant area of concern for teaching and teacher education in the 2000s.

2010s: Transition in Teacher Education, Digital Literacy, and Teacher Identity

Articles from the early 2010s continued to build upon the theme of teacher identity from the 2000s. Three articles published in 2010 and 2011 discussed the topic of teacher identity and beliefs. New topics such as the effectiveness of teacher education, digital literacy among teachers and students, and educational technology also emerged during this decade.

Research Methods

The 20 most cited articles in the 2010s utilized a variety of research methods. This decade saw a split between empirical research (nine articles) and theoretical work (four articles), as well as a split between literature reviews (four articles) and conceptual works (three articles). The majority of the empirical studies utilized qualitative research methods with surveys as the main driver for data collection. Notably, four studies focused on a specific project and international context, surveying a large sample of Norwegian teachers to collect data. While the majority of the empirical studies were qualitative, three of the empirical studies utilized quantitative methods.

Themes

The emergent themes observed in these articles fell into three main categories. Reconceptualizing teacher education was the most prominent theme in the 2010s, comprising eight of 20 articles. Within this theme a range of topics were discussed, including the structure of teacher education, international teacher education, and what the focus of teacher

education should be. The theme of digital literacy or technology integration was another theme that was common, with educational researchers working to understand how the prevalence of technology use impacted student learning, as well as how teachers practiced in the classroom. Teacher identity was a third theme that was well-researched, with the focus being on teacher diversity and teacher beliefs. Woven among these themes were some common topics such as content knowledge, professional development, and teacher burnout.

Reforming Teacher Education

As in other decades previously explored, the subject of improving teacher education was prevalent. Education researchers felt a need to find ways to improve teacher education by analyzing current methods and by reviewing teacher education techniques being used around the world. Comparisons were made between university teacher education programs in the United States and those in other nations. One notable study compared teacher education practice in the United States to those in Finland, Singapore, Australia, and Canada (Darling-Hammond, 2017). This study showed that high-achieving nations are doing more than the United States to recruit and train top-performing teachers. These nations' programs promoted a high level of teacher preparation and professionalism, including requiring advanced university degrees, compensating with high levels of pay, and fostering esteem for teachers among the general population. The author showed that the teacher education efforts in these nations resulted in higher student achievement and greater equality in education. Darling-Hammond contrasted these techniques with those in the United States in which incentives for quick licensure were being used to recruit new teachers, which had a detrimental effect on the quality of education in U.S. schools. She also previously discussed the practice of alternative certification programs in an article emphasizing the importance of quality teacher education to the United States' educational future (2010). This analysis sought to identify how to effectively use practice as a learning tool for new teachers.

Structure and content within teacher education was also a priority for teacher education researchers in the 2010s. The idea of rethinking how campus courses and field experiences worked to train teachers was discussed by Zeichner (2010). He advocated for creating a "third space" to bridge the gap between the university and real-world practice. Zeichner (2012) also warned that the focus on practice-based teacher education may result in disregarding important aspects of teaching such as the historical, cultural, political, social, and economic contexts in which teachers practice. Again, much of this concern came from the movement toward a competency-based and fast-paced teacher licensure route.

The idea of change or redirection within teacher education programs was considered during the 2010s. Kleickmann et al. (2013) analyzed structural differences within teacher education and the subsequent impact on math teachers' content knowledge (CK) and pedagogical content knowledge (PCK). Their study noted differences in the CK and the PCK between European teachers who taught students who were placed in an academic track school (a school where students planned to attend university after secondary school) in comparison with those who taught at a non-academic track school (a school where students did not plan to attend university, but instead they prepared to study trade or skilled labor jobs in postsecondary school). It was observed that teachers' general CK and PCK was directly impacted by their placement. Those practicing in an academic-based school exhibited greater acquired CK and PCK. In addition, a review researched the findings of 110 studies regarding professional development in teacher education, and it was concluded that teacher education had moved away from a traditional in-service training model (Avalos, 2011). Some researchers asserted that by centering teacher education around core practices, the important work of justice and equity in education was being pushed to the periphery. McDonald et al. (2013) criticized the core practice movement and called for (a) recognition that core practices undermined the purpose of public schools; (b) a re-emphasis on the social, cultural, political dimensions of teacher practice; and (c) a re-centering of the educational system on justice with a willingness to recognize historical oppressions and a consideration of how core practices might misalign with equity. Similar research was published in 2019, showing that the movement against core practices and toward a critical theory-based teacher education system had built momentum during the decade (Philip et al., 2019). However, the wide variety of topics found within the theme of teacher education in the 2010s shows that teacher education is complex.

Digital Literacy

An important theme discussed in educational research in the 2010s was digital literacy. While the use of technology in the classroom was not new to the decade, education researchers were trying to determine the best ways to integrate technology in the classroom, to provide training on using technology in teacher education programs, and to instruct digitally literate students. Kirschner and De Bruyckere (2017) argued against the belief that students in the 2010s were "digital natives" with inherent digital capabilities. Their work refuted the idea that these students were multitaskers who were able to complete competing tasks digitally without any detrimental academic impact. Their research showed that digital multitasking actually reduced focus and that students of the 2010s, while more digitally literate than previous generations of students, did not inherently know how to use technology to improve their own academic experience. Educational researchers recognized that students needed digitally competent teachers and that in many ways teacher education programs were not meeting these demands. Instefjord and Munthe (2017) found a gap in the amount of training preservice teachers received and what was actually needed in the classroom. Their empirical study analyzed the results of a survey completed by 654 preservice teachers, 387 teacher educators, and 340 teacher mentors throughout Norway. They found that there was a correlation between teachers' professional digital competence and the digital competence of their teacher educators and mentors. Preservice teachers and teacher educators ranked themselves in a similar fashion in terms of digital competence (medium proficiency), and mentor teachers ranked themselves as having a high amount of digital competency. The authors advocated for greater digital proficiency among teacher educators in order to increase digital proficiency among preservice and new teachers. Similar findings were reported by Gudmundsdottir and Hatlevik (2017) who determined that newly qualified teachers reported poor quality and contribution of information and communication technology in their teacher education experiences.

While the use of digital technology in the classroom was widespread and educational researchers were interested in the impact of teacher education programs on teachers' digital literacy, teachers were also utilizing technology to share knowledge and inform their practice (Macià & García, 2016). In their study, Macià and García sought to answer how teachers were utilizing online communities and networks as a source of professional development. Their literature review of research published after 2009 sought to answer questions such as "What are the main characteristics of the studied learning structures?", "Which theoretical frameworks and research methodologies [had] been used to study online professional development communities/networks for teachers?", "How [was] participation fostered in teachers' communities and networks?", and "What repercussions did participation in online networks and communities have on teachers' professional development?" (Macià & García, 2016, p. 293). Their results found that the full impact of online communities on teacher professional development was unclear and that because the phenomenon of teachers participating in online networks in order to seek professional development was relatively new, more research was needed.

The impact of teacher beliefs on technology integration was also important to educational researchers in the 2010s. Kim et al. (2013) completed a four-year study to examine the relation of teachers' beliefs to their technology integration practices. The goal of this study was to improve the use of technology in poorly performing schools in the southwestern United States by providing new technologies, professional development workshops, and pedagogical assistance. The results of their study showed that teacher beliefs about effective ways of teaching and their technology use were directly correlated. From these examples, we see that the use of technology in classrooms was an important aspect of teaching and learning in the 2010s. Highly cited research articles showed that educational researchers around the world wanted to improve digital literacy among teachers and understand how teacher education and development programs could be used to help educators.

Teacher Identity

In addition to analyzing structure, content, and focus of teacher education, educational researchers also worked to understand how teacher identity, beliefs, and burnout were affecting education. Six of the 20 articles analyzed for this decade dealt with this theme. The overarching target of the research in these areas seemed to be the idea that fostering teacher identity, allowing for teacher agency in the classroom, and studying the impact of teachers' beliefs could help to improve the experience of teachers and aid in avoiding burnout or emotional exhaustion among teachers. Akkerman

and Meijer (2011) began the decade with a review of literature analyzing the concept of teacher identity. They determined that teacher identity went beyond a set of "assets" (i.e., accumulated knowledge, skills, and pedagogical competencies). Teacher identity, instead, should be viewed through a dialogical lens in which the teacher as an agent helps to determine their own professional development needs and trajectories.

In 2010 and 2011, Skaalvik and Skaalvik focused attention on the idea that teacher job satisfaction and self-efficacy were predictors of burnout and subsequent teacher attrition. Their 2010 study showed that collective teacher efficacy was most strongly related to supervisory support (Skaalvik & Skaalvik, 2010), while their 2011 empirical analysis of the relationship among a variety of school context variables, teacher job satisfaction, emotional exhaustion, and feelings of belonging showed that a lack of belonging as well as emotional exhaustion had a direct impact on whether or not teachers were motivated to remain in or leave the profession (Skaalvik & Skaalvik, 2011).

The idea of teacher agency was also explored during this decade. It was recognized that teacher beliefs impacted a teacher's choices in the classroom and thereby had a direct impact on student learning. Worldwide, there was tension within educational institutions between those who would encourage teacher agency and those who sought to minimize it (Biesta et al., 2015). In a 2015 survey of teachers who were involved in a curriculum change project in Scotland in which teachers were positioned as agents of change, it was found that teacher beliefs regarding teacher responsibility and the purpose of education had a direct impact on teacher agency (Beista et al., 2015). Authors of that study recognized that a deficit of discussion regarding the purpose of education existed and that more robust conversation in this regard was necessary.

Discussion

One clear takeaway from the articles in this decade is that they built upon work done in previous decades. The 2000s discussed a need for high-quality teacher education and the 2010s built upon that with many articles discussing effectiveness of teacher education. Further, the new focus on technology in the 2010s created an additional facet of high quality teaching and teacher education. By digging into what types of teacher education are effective, the articles in the 2010s added detail to what makes teacher education high quality.

2020 and Beyond: Technology, Online Learning, and Race

The 20 most cited articles from the year 2020 in teaching and teacher education represented many topics and themes. In this analysis, we will discuss the themes of technology in education, online learning (in the context of COVID-19), and race. We will also consider common types of research used as well as trends and possible future research.

Research Methods

The 20 most cited articles from 2020 mostly fell into one of three types of research: empirical studies (10), literature reviews (7), and theoretical papers (2). The top three most cited papers fell into each of these categories with the most cited being an empirical study, second-most cited a theoretical paper, and the third-most cited a literature review.

Themes

There was a wide spread of where these articles were published compared to previous decades. The 20 articles were published across nine different journals. Two or more articles were published across seven different journals with the plurality of articles (four) coming from the *Journal of Teacher Education*.

There were many different topics that were published in 2020. The three most popular topics were technology (three), online learning and COVID-19 (two), and race (two). The remaining articles dove deeply into one specific topic, subtopic, or idea, preventing their thematic classification.

Technology

Of the three studies that discussed technology, each focused on a different aspect of technology. Casillas Martín et al. (2020) focused on early childhood education preservice teachers and studied their feelings about information and communication technologies (ICT). Overall, the preservice teachers had very positive views of ICT. They had moderate confidence in their abilities to use ICT, and they felt their knowledge about ICT (how to effectively use it in the classroom, what types of technology are out there, etc.) was minimal.

Walkoe and Elby (2020) also focused on preservice teachers, but they studied how preservice teachers used technology to enhance their teaching skills. They had preservice teachers use a video tagging program to notice and reflect on things happening in the classroom. The article found that preservice teachers could both notice the same moment but have different interpretations for what was happening at that moment.

Instead of focusing on preservice teachers, Maas and Hughes (2020) reviewed the current research about virtual, augmented, and mixed reality technologies in K–12 education. Of the 29 studies that were considered, most focused on augmented reality, with only three studying mixed reality and one studying virtual reality. Within those studies, many topical themes emerged, including collaboration and communication, critical thinking, attitude, engagement, learning, motivation, and performance or achievement.

Online Learning

Online learning became an important theme in 2020. With the worldwide COVID-19 pandemic disrupting traditional schooling for most of the world at the end of the 2019–2020 school year, some of the articles in 2020 focused on the effects of completely transitioning to online learning. A few journals even ran entire special issues on this topic.

The most cited article from 2020 was by König et al., and it focused on early career teachers in Germany and how they were handling the shift to online learning due to the pandemic. The study focused on the first few months of the pandemic, and during those months, early career teachers in this study generally maintained regular contact with students and parents, introduced new content to their students, assigned tasks, and provided feedback. Skills in online teaching and online assessment were not used as much nor did teachers have as much confidence in being able to use those skills.

Carrillo and Flores (2020) did a literature review of different studies focusing on online learning. They came up with three themes that were present throughout their literature review. Their research reaffirmed the need for the presence of the three elements of the CoI Framework—teacher presence, social presence, and cognitive presence (Garrison, 2009)—in online learning in order for it to be successful. Carrillo and Flores (2020) also discussed the "blurred line" between the need for social and cognitive presence. However, teacher presence had strong connections to both the social and cognitive presence in online learning and teaching. Because of that finding, the authors stated there needs to be more research on the "social and collaborative components of learning" (p. 478) in online pedagogy. These findings provided insight into online learning in education research. The research in 2020 on remote learning showed how the field of education research responded and found solutions to challenges that arose in teaching and teacher education.

Race

There were two articles that focused on race from 2020. The first was by Shah and Coles (2020). In this article the authors discussed the term racial noticing, which is bringing awareness to racism and acknowledging possible or potential racism around us. This study called for preservice teachers to be educated in anti-racism before they begin teaching in the classroom.

The other article by Baker-Bell (2020) discussed anti-racist Black language pedagogy. The author gave a history of Black language in the classroom, discussed the linguistic inequalities in English Language Arts (ELA) classrooms, and interrogated the notion of "academic language." The author also provided an ethnographic approach in understanding how an all-girls ELA class of ninth graders in Detroit who identify as Black or African American reflected on anti-black

linguistic racism. The theme of race in teaching and teacher education indicates a need for further research and continued improvement on how race impacts students and their learning.

Discussion

The theme of technology carried over from the 2010s into 2020. Considering the opportunity for increased digital literacy in classrooms due to the COVID-19 pandemic, technology may be more relevant to teacher education than ever before. As the 2020 decade continues, we anticipate there will continue to be a large push for more online learning, technology, and digital literacy research. Additionally, we anticipate that there will be more research on how education was handled during the COVID-19 pandemic. Race has emerged as a prominent topic of discussion and research during this decade, and we expect it will continue to influence teaching and teacher education research throughout the rest of the 2020s.

Synthesis of 50 Years

Common Themes

Many themes emerge as we look back over the last 50 years of research in teaching and teacher education. We will be focusing on the five main themes of the decades: teacher identity and teacher beliefs, teaching methods, teacher education reform, English as a second language (ESL), and cultural awareness.

Teacher Identity and Teacher Beliefs

Over the last 50 years, every decade has included some research in the 20 most cited articles about teacher identity or teacher beliefs. These articles focused on how the teachers viewed themselves in or out of the classroom, what beliefs teachers came into the profession with, how those beliefs changed as they taught, and who influenced teachers' identities or beliefs.

Teaching Methods

The study of different teaching methods was also prevalent in each decade of the last 50 years. The methods themselves have changed from 1970 to 2020, but the idea that new methods and more effective methods exist has continued to progress over time.

Teacher Education Reform

Another theme we found throughout all of the decades was the idea of teacher education reform. Each decade had articles that called for reforming teacher education to improve it for both teachers and future students. Again, like teaching methods, the actual calls for reform look different throughout the decades, but the idea of change and improvement is there across the last 50 years.

English as a Second Language

ESL is the only subject-specific theme that emerged in our research, but it wasn't initially a prevalent theme. Only one article in the top cited research during the 1970s focused on ESL teaching. In contrast, in the 1980s, 11 of the top 20 cited articles focused on second language acquisition. This focus continued throughout the 1990s, and then this theme was not seen among the top cited research again until the year 2020. These trends show that helping learners acquire skills in ESL was important to educational researchers, even though the emphasis on ESL research varied across the decades.

Cultural Awareness

Cultural awareness research started to pop up in the 1990s where researchers were focusing on various cultures and how those cultures impacted or could impact classroom learning. This theme of cultural awareness continued through the 2000s, 2010s, and most recently, in 2020.

Important Issues, Topics and Trends

Race and Culture

The awareness of race and culture in teaching and teacher education research evolved from 1970 to 2020. In the 1970s, little research focused specifically on race and culture. Instead, some articles targeted students for whom English was not their first language. They explored how culture impacted English as a second language (ESL) students or second language (L2) users. In the 1970s, they used terms like native and non-native speakers (Reid, 1987). Rampton (1990) examined the issues with those terms and suggested replacing them with more appropriate terms. As ESL research continued to progress, Silva (1993) proposed a need to develop theories and practices that appropriately addressed the multilingual and multicultural perspectives of L2 users. At the end of the 1990s, there was a movement to correct how others perceived the L2 users and how L2 users perceived themselves. Cook (1999) found that having a positive image of L2 users can help them recognize they are successful multicompetent speakers, not failed native speakers.

As the research progressed through the decades, there was a stronger emphasis on teaching and teacher education research directly related to race, culture, and socioeconomic status. Mol et al. (1992) used the phrase “funds of knowledge” to describe something more encompassing than the phrase “culture.” Funds of knowledge is the knowledge that pertains to the social, economic, and productive activities of people in a local region. Moving forward, practitioners, communities, and families can work together and combine resources to magnify the funds of knowledge that can bring educational change. In the 2000s, Gay (2002) discussed the importance of culturally responsive teachers and their impact on the academic success of ethnically diverse students. Almost two decades later, Shah and Cole (2020) called for more teacher education about race and racism. As a result, we see that culture, race, racism, and anti-racism have been more centrally discussed in classroom settings. After recent events in the United States, such as the killing of George Floyd and the expansion of the Black Lives Matter movement in 2020, we expect to see more studies about race, racism, and anti-racism moving forward.

Author Diversity

There was as much variety in the authors as there was in the research in teaching and teacher education research. There were three main trends: (a) an increase in articles authored by multiple authors, (b) an increase in female authors, and (c) an increase in the number of international articles. In the 1970s and 1980s, less than half of the articles had multiple authors. Progressing through the decades, the number of multi-authored articles increased. In the 1990s, more than half of the articles had multiple authors. In the 2010s and 2020, more than 15 of the 20 top cited articles had multiple authors. Starting in the late 1980s and early 1990s, there was an increase in female authors. In the 1970s, there were only four female authors. In the 1980s and 1990s, there were more than 10 female authors. By the 2000s, more than half of the articles had at least one female author. This trend continued in the 2010s and 2020. The third major trend in authors was the increase in international authors through the decades. In 1970 there was one international research article. The number of international articles increased drastically through the decades. By 2010 there were at least six international articles, and in 2020 over half of the articles were international articles.

Influence of Teacher Attrition

According to data from Carver-Thomas and Darling-Hammond (2017), teacher attrition increased dramatically from the early 1990s into the mid 2000s. We believe that this increase in teacher attrition contributed to much of the most cited research throughout the 2000s and 2010s. In particular, we saw much of the top cited research had trends in (a) improving the quality of teacher education and (b) teacher identity, which could both relate back to the issue of teacher attrition.

The trend of quality of teacher education was first apparent in the 2000s. Darling-Hammond (2006) addressed the issue as she warned of the dangers of watering-down teacher education. Grossman et al. (2009) and Loewenberg Ball and Forzani (2009) added their work on how to improve professional development to better prepare teachers for the complexity of the teaching profession. Avalos (2011) reviewed 111 publications from Teaching and Teacher Education from 2000–2010 and found effectiveness of professional development to be a major theme in the studies. Darling-

Hammond (2017) continued her focus later in the 2010s by comparing U.S. teacher education with teacher education programs in other countries.

The trend of teacher identity also appeared around the same time. Beijaard et al. (2004) seem to have sparked a string of influential work on professional identity by reviewing much of the work already done on teachers' professional identity and proposing ways to better guide research on the topic. Flores and Day (2006) published a qualitative study to better understand what shapes and reshapes new teachers' identities, and Tschannen-Moran and Hoy (2007) added their qualitative research that focused on the source of teachers' self-efficacy beliefs. This trend continued into the 2010s with work from Skaalvik and Skaalvik (2010) that examined relationships between teacher self-efficacy beliefs and teacher burnout, with Hong (2010) and Akkerman and Meijer (2011) also publishing influential research on teacher identity in the early 2010s.

Evolution in ESL Teaching

ESL teaching is the only subject-specific theme that emerged from our analysis of teaching and teacher education research. A study of the top cited articles discussing teaching English as a second language (ESL) and related topics from 1970 to 2020 revealed a range of issues and trends. The approach to ESL and second language acquisition evolved through the decades.

Research on ESL teaching comprised 18% of the top cited articles over the past 50 years. This research was a primary focus during the 1980s and 1990s. During the 1980s, this theme comprised 11 of the top 20 cited articles. The trend continued into the 1990s to a lesser extent, with seven of the 20 articles. Only one article focused on ESL during the 1970s and none in the 2010s. While the topic was not mentioned during the 2000s, cultural awareness and diversity were prominent during this decade. The theme of ESL resurfaced during the year 2020 with three highly cited international articles.

Over the course of the five decades analyzed in this synthesis, the methods used in second language (L2) instruction evolved from an emphasis on the most efficient way to instruct children and young adults in English as a second language to a more learner-oriented approach which emphasized learner choice. During the 1980s, educational research focused on learning strategies and styles as well as practice-based methodologies such as group work, native speaker and non-native speaker (NS and NNS) interaction, and the effectiveness of direct instruction versus exposure acquisition. The focus on learning strategies and styles resulted from the view that knowing the process, rather than just the product of learning, was needed to move from "head-scratching" to designing programs that met the varying needs of students (Block, 1986). Early in the decade, researchers analyzed the effectiveness of direct instruction, whereby a student acquires a second language by interaction with a teacher in a structured setting, as opposed to exposure to the second language in use or a combination of the two (Long, 1983). Long's research analysis concluded that direct instruction benefited ESL students, and subsequent researchers worked through the decade to understand the best methods to include in the ESL classroom. Those methods included group work, interaction, and interlanguage talk. Long and Porter (1985) provided evidence that group work and interlanguage talk, or conversation between non-native speakers, were highly beneficial to second language acquisition. This research encouraged a move away from what Long referred to as "lock-step" teaching and a pedagogical emphasis to a more psycholinguistic approach in which NS/NNS interaction was valued in the ESL classroom.

Late in the 1980s, Pennycook (1989) asserted that the focus on methods in language teaching was erroneous, claiming that this perpetuated inequities in education. This change from English language teaching methods as the primary research focus to a more socially aware field of study continued primarily through the first half of the 1990s. In contrast to the 1980s, none of the top cited articles during the 1990s analyzed ESL from the lens of teaching methodology, content, or practice. Instead, researchers in the 1990s focused attention on a range of topics, which included the implications of gender differences in L2 acquisition (Green & Oxford, 1998), the shift away from the native speaker in ESL classrooms (Cook, 1999), the social identity of language learners (Peirce, 1995), and the social ramifications of ELT (Ricento & Hornberger, 1996). In 1998 Johnson and Freeman urged a reconceptualization of English language teacher education with the intent to place emphasis on the sociocultural context in which ELT professionals work.

Research during the 2010s was not primarily concerned with the theme of ESL, as it did not comprise any of the 20 top cited articles during that decade. However, this theme resurfaced during the year 2020 with three articles, each of which approached L2 instruction from a different perspective. These three articles dealt with language use in the classroom (Brevik & Rindal, 2020), teacher metacognition (Yuan & Zhang, 2020), and student voice (Lee & Butler, 2020). Two of these studies differed notably from the research during the 1980s and 1990s in that these studies were located outside of the United States and focused on students learning English as a second language in a school or university setting in which the students themselves were native speakers. This was in contrast to the earlier research, which was comprised of mainly immigrant students in the United States at either secondary, university, or community levels. The range of topics within the theme of ESL during the past 50 years revealed an evolving approach to ESL teaching and L2 students.

Data Sources

We synthesized the research of teaching and teacher education from 1970 through 2020 and identified the trends and themes of that period. In doing so, we found that all the top cited articles came from thirteen journals. Our research provides insights into how many articles in each decade came from a particular journal and how they aligned with the themes of the decade. For example, we found that some journals dominated the decade. In the 1980s, 11 out of the 20 top cited articles were published in *TESOL Quarterly*. During the 2010s, 50% of the top cited articles were published in *Teaching and Teacher Education*. In addition, we found that from the 1970s to 2020, the variety of journals increased. For example, in the 1970s, all of the top cited articles came from four journals. In contrast, during the year 2020, the top cited articles were published in nine journals. In every decade, there were at least two articles published in the *Journal of Teacher Education*. Further research is needed to examine publishing trends, such as the number of published journals in each decade and other factors that could have favored one journal above others in search methods and citation frequency.

Limitations

A limitation of our research is the brief amount of time articles from 2016 to 2020 have had to be cited. Because articles in this range have only had between two and five years to be cited, our research could be skewed toward articles published earlier in the 2010s. For instance, 13 of the top 14 most cited articles from the 2010s came from 2010–2013. Similarly, because 2020 was only one year ago, there has not been much time or opportunity for articles to be cited. As the 2020s continue, the 20 most cited articles may shift and change, and our current analysis may become out of date. The COVID-19 pandemic also may have had an impact on publishing, research, and studies that we may not see until later in this decade.

Missing Links, Topics, and Trends

Bullying

The prevention of bullying is a priority in many schools (Drake et al., 2003). However, in the top cited articles in the last 50 years there was only one article that addressed bullying. It is notable that bullying was not included in the top cited research for any of the other decades, considering that bullying often impacts student learning dramatically.

Teacher Training in Educational Technology and Online Learning

During the 2010s and into 2020, there were a number of articles that discussed the need for preservice teachers to receive more training on using technology in the classroom. Björk and Edvard (2017) found that new teachers indicated their training in using technology in the classroom was not adequate. While there has been research on technology use in the classroom over the past few decades (see the “Educational Technology” chapter of this book), the topic of online learning was missing from the top cited articles in the 2010s. However, we predict that online learning will become more of a focus in top cited articles in the coming years.

Cultural Awareness within ESL Teaching

The presence of the second language learner’s culture and its direct influence on the acquisition of a second language is notably absent in the 22 articles concerned with ESL cited in this review. A survey of the articles from the 1980s

reveals this void when it comes to analysis of the culture of ESL students. Seven of the 11 articles that studied ESL during the 1980s contained empirical studies, and the authors disclosed the nationalities of the subjects. However, no mention of the influence of the subjects' cultural background or its influence on learning was made during any of the studies. Subjects came from a variety of nations located in Asia, Europe, and South America, but the influence of these various cultural backgrounds was not evident in any of the studies produced during the 1980s. In 1989, Pennycook criticized the ELT profession for imposing Western culture on L2 students. This was echoed by Ricento and Hornberger in 1996 as they advocated for change in the field of language planning policy. Indeed, researchers in the 1990s adjusted their focus to include sociocultural context within ELT. However, the direct impact of a student's native culture on the acquisition of a second language was still missing from the top cited research. One article urged a recognition of the L2 speaker as "between two cultures" and advocated a move away from measuring L2 competence against a rubric that focused on native speaker traits (Cook, 1999, p. 200) but did not discuss the subject of the ELL's native culture. Freeman and Johnson in 1998 suggested redefining the approach to language teacher education by focusing on the sociocultural context of teachers' experiences. Even though these shifts were reflected in the research, a lack of specific research on the sociocultural experiences of ESL students was evident.

Conclusion

Our analysis of the past 50 years of research in teaching and teacher education reveals sweeping changes. Early decades of research analyzed in this review showed a system of teaching and teacher education concerned with students' achievement as measured by standardized testing and what was considered to be academically sound for the time. This included specific teacher practices, classroom behavioral norms, and rigorous academics. Early research showed little to no attention given to the sociocultural influences on students or teachers. This began to change during the 1990s when a new focus on the impact of both students' and teachers' varied cultural contexts emerged. Throughout the 2000s, 2010s, and the year 2020, research on teaching focused primarily on sociocultural influences in the classroom, with student achievement and teacher practice taking a backseat. In addition, research during the 2000s and 2010s focused on improving the quality of teaching, defining a "good teacher," and comparing the U.S. educational system with international educational systems.

Throughout the 50 years of research that we analyzed, we also noted that broad changes took place in teacher education. During the 1970s, teacher education was focused primarily on teaching strategies and the variety of outside influences that impacted preservice teachers. However, during the 1980s, educational researchers were calling for the need to reform teacher education for the university setting to have a lasting impact on new teachers. Teacher education reform remained a theme from the 1980s through the 2010s. During the 2000s and 2010s, researchers worked to understand how teacher beliefs and efficacy impacted the experience of preservice and in-service teachers. Research during this time explored new ways of helping teachers acquire desired beliefs and attitudes. From 2000 to 2020, a new focus on innovation and technology was exhibited in the research. It is anticipated that this focus will continue throughout the 2020s as educational researchers analyze the effects of the swift implementation of online teaching and learning due to the COVID-19 pandemic.

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Why Do Faculty Resist Change?

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Teacher Professional Development

Resistance

Professional Development

Faculty change

Background: Much of what an educator needs to know to be successful is invisible to lay observers, leading to the assumption that teaching requires little formal study. Aims: This study is based on an 8-month faculty development workshop on student-centered teaching. Faculty members who made no noticeable changes in their teaching practices were compared to faculty who made noticeable and significant changes. Method: Using a qualitative narrative approach based on a structured interview, we aimed to categorize the features of changers and resisters. Results: Faculty resisters did not see any need for changes in the way we teach, did not believe student-centered teaching to be more effective, could not appropriately define student-centered teaching, were motivated by extrinsic factors, and felt undervalued. Conversely, faculty changers were excited for changes and saw the need for change and for student-centered teaching, were intrinsically motivated, and felt valued as faculty members. Conclusion: We hypothesize that a main reason for resistance is the status quo bias. Implications for faculty development are discussed.

Introduction

Efforts to improve teaching are not unique to dental education. A systematic review examining teaching effectiveness in health professions education determined that faculty members in general lack formal training in educational methodology and pedagogy. The review emphasized how faculty development is needed (Steinert *et al.*, 2006).

Furthermore, cognitive psychologists aptly summarize a major critique of higher education: "It would be difficult to design an educational model that is more at odds with current research on human cognition than the one that is used at most colleges and universities" (Halpern and Hakel, 2003, p. 4). Yet many faculty members seem unaware of this research or resist giving it serious attention.

As Derek Bok, president *emeritus* of Harvard has put it, "No faculty ever forced its leaders out for failing to act vigorously enough to improve the prevailing methods of education. On the contrary, faculties are more likely to resist any determined effort to examine their work and question familiar ways of teaching and learning" (Bok, 2009, p. 334).

Much of what an educator needs to know to be successful is difficult to quantify, leading to the assumption that teaching requires little formal study. If a faculty member has acquired knowledge of a certain discipline (e.g., dentistry), we assume they are qualified to teach. However, it has been shown that faculty teach in the way they themselves were taught, "using instinct, trial, and personal experience" (McAndrew, Motwaly and Kamens, 2013, p. 716). With half of the new faculty members coming into dental education from private practice and 18-21% join after graduating from an advanced education program, dental schools must find ways to develop teaching expertise.

Complicating the lack of formal education training for dental educators is the vigorous and frequent reminders that effective pedagogy has evolved, and what they have done in the past is outdated and needs to improve. This article proposes an explanation for individual resistance (or acceptance of) nontraditional educational pedagogies. The focus of the article is how faculty perceive administrative calls for improved teaching and how this process influences individual resistance of new or changing pedagogies. Procedures for decreasing individual resistance to (and, hence, increasing acceptance and use of) active learning methods are suggested.

Methods

This study is based on an 8-month faculty development workshop project in which faculty members committed themselves to learn about and implementing student-centered teaching in their existing courses. The workshops were scheduled between January 2017 and June 2017 and were endorsed by the Office of Academic Affairs, who requested that all full-time faculty, adjunct faculty, and hygienists attend all sessions of the series. Participants were observed before and after the workshop by trained observers using the Classroom Observation Protocol for Undergraduate STEM (COPUS) (Smith *et al.*, 2013). Those who made noticeable changes were considered 'acceptors', and those who made no change were considered 'resisters.' (Individual COPUS data is not presented in this manuscript, but is included in a different study, currently unpublished.) While research from this workshop indicated that detailed and directed pedagogical training could cause a change in instructor teaching practice from teacher-centered to more student-centered methods in some, we sought further understanding about those who did not change.

For the purpose of gathering information, we used a qualitative narrative approach based on a structured interview with participants of the faculty development workshop. Twenty faculty members participated in all of the workshops. We chose from among the many faculty who made significant changes to be our faculty acceptors group. Only four faculty members made no changes at all and made up our faculty resisters group. Two of these four agreed to participate in our interview process as faculty resisters.

The interviews took place 4 months after the completion of the faculty development workshop series. The privacy of the informants was achieved by receiving their written permission to record the interviews and by the strict use of pseudonyms in all written transcriptions. All faculty members were asked the same questions before researchers completed the thematic analysis (See Table 1):

Table 1: Interview questions asked prior to the intervention

Question

How did you teach before the faculty development workshops?

How has your teaching changed since the faculty development workshops?

Question

What is your motivation to be an educator?

What are your concerns with student-centered teaching?

What evidence would convince you that student-centered teaching is good?

What evidence would convince you that student-centered teaching is bad?

What was your opinion going into the faculty development workshops?

What would you change about the faculty development workshops?

What resources should be provided to dental educators?

What incentive structure should be in place for dental educators to transition their classrooms to be more student-centered?

How would you help someone else who is resistant to student-centered teaching?

All interviews were recorded and transcribed according to guidelines established by the Institutional Review Board. Using transcription notes, a thematic analysis was completed on each of the interviews. The procedure for this analysis required researchers to create themes that emerged from the data rather than establish groupings according to an existing theory. The data were read and then reread to categorize teacher views. Similarities and differences across and within participants were examined.

In order to avoid subjectivity in the initial selection of categories and to assure trustworthiness, these themes were identified by each of the four researchers separately, who then compared notes and agreed upon a list of preliminary categories of responses. The final themes were determined at a second and third phase of discussion. The primary author trained the researchers in the method before they began thematic analysis.

Results/Analysis

Generally speaking, faculty resisters did not see any need for changes in the way we teach and did not believe student-centered teaching to be more effective, while faculty acceptors were excited for changes and saw the need for change and for student-centered teaching. Furthermore, those resisting change did not know the meaning of student-centered teaching (even though this was the focus of the workshop). It was also noted that faculty resisters were motivated by extrinsic factors (salary and recognition) but did not feel valued. On the other hand, faculty acceptors were intrinsically motivated and felt valued as faculty members. See Table 2.

Table 2

FACULTY RESISTERS	FACULTY ACCEPTERS
Don't see a need for change	Excited and see a need for change
Don't know what SCT is	Want to know what SCT is
Don't think SCT is better	Recognize SCT is better
Extrinsic Motivation	Intrinsic Motivation

FACULTY RESISTERS

Don't feel valued

FACULTY ACCEPTERS

Feel valued

A Need for Change?

Faculty acceptors were excited, grateful, and appreciative of the pedagogical training. These faculty sensed that students were hungry for reform and that traditional models of education were not effective. Furthermore, they even suggested there should be accountability for those faculty unwilling to change their teaching methods. In contrast, faculty resisters saw no reason to make any changes. Comments from these faculty suggest a weariness and frustration with change efforts, indicating that they felt like the system did not need fixing. These faculty also mentioned their teaching experience and the awards they had received as evidence of their effectiveness. One faculty member indicated change mandates stemming from dental educators with additional degrees were "dangerous." Example quotes from interviews are shown in Table 3.

Table 3: Example quotes regarding the need for change.

FACULTY RESISTERS**Don't see a need for change**

"I rebel against [being asked to change]. I'll be quite honest with you. But as I say that I don't think there isn't room for improvement. Um, but my opinion is that if, I hate to say this, if it's not broken, let's not fix it."

"One of the problems in dental education is that a lot of things are being changed just for the sake of change. They start changing things just for the sake of changing them, and they throw things away that are really good."

"I'm going to say something that's going to throw you for a spin. I have had a lot of experience, and personally I think that dentists get higher degrees in education, and start applying those things in dental education, and I think it can get a little bit dangerous."

"My opinion is that if it's not broken, let's not fix it."

"I was offered a job and I made an immediate impact, which I expected because I've had ten years of teaching experience."

"That is what is so puzzling to me, is why, if we were doing so well (residency acceptance, board scores), do we have to shift gears totally in what we're doing?"

"I was applauded at my previous institution."

"[At my previous institution] I got positive regard from fellow faculty and administrators all the time. Makes me wonder, 'why the heck did I leave there?'"

"[At a previous institution] I was given an award five years in a row by the students for excellence in teaching. Since

FACULTY ACCEPTERS**Excited and see a need for change**

"I was excited. Like when the Dean said we are going to transform education, I was excited. Yeah! Let's do this!"

"I am grateful to this school, the dean, and this workshop! It's made a difference for me, and I really appreciate it, even though it's been a lot of work."

"I was in private practice for 25 years before I came here. And it's like, if you are not meeting the outcomes, you are out of the game. You are out of business. You are done. The education model is not like that. It's like you can sleep and lumber along under the radar for your whole career. I think there needs to be some consequence."

"It seems students are hungry for something different."

"There is an extreme need for reform."

"My motivation was, I had always felt, personally I had always felt like something is wrong with education. We're not getting the most out of it, or it's not as effective as it could be."

"There should be some accountability for not changing."

FACULTY RESISTERS**Don't see a need for change**

coming here, I have also received those awards. What that tells me is that my method works."

FACULTY ACCEPTERS**Excited and see a need for change**

Understanding Student-Centered Teaching

After the faculty workshop, those incorporating a more student-centered approach were quick to admit their need to learn more about effective pedagogy. Those maintaining traditional methods seemed not yet to understand the principles of student-centered teaching, either admitting that that was the case or claiming to have already adopted the methods (which was contrary to data collected via classroom observation protocols). Example quotes from interviews are shown in Table 4.

Table 4: Example quotes regarding understanding of student-centered teaching

FACULTY RESISTERS – Don't know what SCT is	FACULTY ACCEPTERS – Want to know what SCT is
"Student-centered vs. teacher-centered. That makes no sense to me.	"I have so much to learn. I want to be better."
"I'm already using all the methods being taught in this workshop."	"I want to be a good teacher, but I need help."
"I'm under the impression that people think [the way students learn] has changed, but I don't know if I buy that."	"When I first came here to teach, I would sit through other lectures and realize this is painful!" When I started doing my own research into education, I realized there was a much better way. I just didn't know how to start."
	"I have a lot to learn, but I do know that we learn by doing!" You don't ride a bike by talking about it. You get on it, you fall down, you get up, and you do it again."
	"My only concern is that I have so much to learn! I need to get better at how I implement [active learning] and do it."

Confidence in Student-Centered Teaching

During the faculty development workshop series, evidence was presented to highlight the research behind student-centered teaching. Despite the presentations, not all were confident in the research. Faculty acceptors referenced the positive experiences they had with students and the positive comments made by students. They mentioned the data and were confident the new method was effective. On the other hand, faculty resisters were not confident in the approach and worried that the new teaching styles would not effectively prepare students for their board exams. Example quotes from interviews are shown in Table 5.

Table 5: Example quotes regarding confidence in student-centered teaching

Maldonado, N., & Yuan, T. (2011). Technology in the classroom: from Ponyo to "My Garfield Story": using digital comics as an alternative pathway to literary composition. *Childhood Education*, 87(4), 297-301.

FACULTY RESISTERS – Not convinced SCT is better	FACULTY ACCEPTERS – Recognize SCT is better
"It seems we are being asked to throw away everything we're doing and let's be entertainers to these students."	"When I taught using the new techniques [taught in the workshop], the students loved it! They asked me, 'why didn't we do it this way sooner?'"
"Things are trying to get so accelerated and so streamlined, so to speak, that we're leaving out some real	"The research is clear that lecture doesn't work."

FACULTY RESISTERS – Not convinced SCT is better	FACULTY ACCEPTERS – Recognize SCT is better
fundamental things."	
"[Active learning] has some positive attributes. There are some that go a little further than I'm willing to go. I've always done it my own way."	"The way I was taught was PowerPoint and 'read the book.' And then you go to class and are just expected to regurgitate what you just read. I know I personally learn through discovery, but that is not how we teach."
"I'm just worried about the board results, and I'm worried about the students."	There is so much data out there! I mean, going back to the early 1900's that lecture is not an effective way to deliver material that is going to be retained long term."
"We may be facing a problem with the board, with a failure rate. I have had a 100% pass rate with the board, but now I don't know what is going to happen. I'm predicting a higher failure rate on the boards."	"I am so excited to improve and change. The learning model here is focused on active learning. That is what drew me to this school."
"It was a lot of work to change my class, and sometimes I was like, 'ahhhhhhhhh!' But once you get the feedback from students, OK, it was worth it."	"I knew [lecture] wasn't the best."
	"After changing my class, students expressed appreciation. They knew that there was effort placed in the teaching method vs. just putting out a PowerPoint lecture and talking about it."
	"With this class I had so much more feedback than before. Students were like, 'wow, this has been awesome.'"
	"[My supervisor] and the Dean have been very forthcoming in their praise for the changes I am making, and that is rewarding. But the reason I am changing is because I feel like it's just a better way that learning happens. That is why I got into education in the first place."

Motivation

The faculty who adopted student-centered methods made comments suggesting they were more intrinsically motivated. For example, they wanted to be better teachers and mentioned doing what was best for the students. Those rejecting these changes were more motivated by extrinsic factors such as salary and recognition. Example quotes from interviews are shown in Table 6.

Table 6: Example quotes regarding motivation for change

FACULTY RESISTERS – Extrinsic Motivation	FACULTY ACCEPTERS – Intrinsic Motivation
"I think money would be a good incentivize"	"I love working here at [this school]. I love wanting to be better and an asset to the University, so I had to step out of my comfort zone."
"As an incentive, I think that monetary and rank advancement would be a good incentive."	"I was initially resistant to change because I was scared, but I realized how much I care about the students. That is what motivates me to improve."
	"If I were to discover that there is something that I am doing that could be improved, then I would do it. I don't know that getting an award from the Dean, something that

FACULTY RESISTERS – Extrinsic Motivation**FACULTY ACCEPTERS – Intrinsic Motivation**

	I could put on my door or my wall or whatever, is going to motivate me."
	"So, my main motivation would probably be... I just feel [the students] learn better." "
	My biggest motivator is internal drive for excellence, and then the second biggest is I need to provide for my family."

Feeling Valued

Whether or not the faculty felt valued at their institution was also a theme that emerged from the interviews. Those who changed their teaching practices felt valued, while those who did not change their teaching did not. Furthermore, these faculty members mentioned a negative culture. Example quotes from interviews are shown in Table 7.

FACULTY RESISTERS – Don't feel valued**FACULTY ACCEPTERS – Feel valued**

"There has been no recognition here"	"I feel valued here at [this school], and that makes me want to improve."
Regarding feedback: "There has been nothing positive."	"Some people may be motivated by monetary compensation, but I think a bigger motivation for most people would just be recognition that you are valued. I have felt that here."
"It's been negative [at this institution] for sure"	
"Well, I'll tell you, one thing that would really help is if an administrator would come up to me and say, 'hey I heard you had a good [...] course this year. Way to go! I'm glad you're here.'"	
"[Positive praise] has never happened here. Never! Not once."	

Discussion

After the 8-month faculty development workshop, our research indicated that detailed and directed pedagogical training could cause a change in instructor teaching practice from teacher-centered to more student-centered methods for many faculty participants. Specifically, twenty-one of the twenty-five participants made noticeable changes in their teaching practices. In this project, we chose to utilize a narrative analysis to better understand the perspective of those rejecting change efforts and to compare them with the majority of participants who made changes.

The emerging themes from our analysis led us to the theoretical explanations offered by the status quo bias (Samuelson and Zeckhauser, 1988), which is a preference for leaving things as they are. Changes in pedagogy hope to improve student learning, but some faculty only see the loss of what they have always done. The faculty members we interviewed who did not change were quick to mention their teaching experience and teaching awards as evidence of the effective status quo. That they were also motivated extrinsically by recognition allows us to gain insight into what they might lose if they were asked to change what they had always done. They might lose the recognition that had brought them to where there were now.

Why is the status quo bias so powerful? Samuelson and Zeckhauser (1988) theorized that it is often an effort to resolve cognitive dissonance, especially in terms of one's own worth as a decision maker. Asking a faculty member to change how they teach is perceived as an attack on how they have always taught. Past choices are rationalized, even when new

evidence suggests improved methodology. The status quo bias limits our ability to change, and the evidence indicates that it applies at least as powerfully to college professors as to any other segment of the population (Tagg, 2012).

Many of our faculty, however, accepted student-centered teaching, so it is important to ask, "why did only some of the faculty fall prey to the status quo bias?" As reported above, we found that faculty with more experience were less likely to change their teaching practices after pedagogical training and to resist student-centered teaching. This finding is consistent with the research reviewing the literature on the development of pedagogical knowledge for educators (Prosser and Trigwell, 2001). This data leads us to hypothesize that more experienced faculty have a stronger status quo bias when introduced to pedagogical change.

How can we create a career path for faculty who are afraid of losing their present successes? Case studies detailing change efforts within dental education have indicated some success in implementing large-scale changes throughout a curriculum (Nadershahi *et al.*, 2013). A review of these case studies in light of the emergent themes from our interviews would direct us to (a) discover solutions that involve faculty in discovering the perceived need for change, (b) help faculty understand the outcomes of student-centered pedagogies, and (c) properly motivate and value faculty in their ongoing efforts. The following recommendations are provided in view of our findings:

1. Frequently engage faculty in the process of change. Dedicate the time required to adequately discuss the reasons and benefits of reform.
2. Clearly define what it means to reform and come to a consensus. Discuss what it means to reach these benchmarks and how success will be gauged. Appoint an appropriate entity to gather data and report back to faculty.
3. Recognize faculty for outstanding contributions to student-centered teaching, and value these contributions equally with research and service when evaluating academic promotion.
4. Secure sufficient resources to support faculty as they reform, including academic promotion incentives and faculty development costs.

Conclusion

A narrative analysis allows us to focus on an individual perspective and is relevant when that story might be validated by a greater audience. With the ongoing discussion to change dental education and the subsequent findings of faculty resistance to these changes, this approach was seen as an appropriate investigation into pertinent barriers to change for faculty resisters. Understanding the restrictive pull of the status quo bias can give insight to overcome it as an obstacle for change.

Take Home Messages

- Faculty development does not always lead to noticeable changes.
- Faculty who resist change are likely unaware of the need for change, unaware of student-centered approaches, motivated by external factors, and perhaps undervalued by their peers.
- Faculty who embrace change are likely aware of and excited about change, interested in learning new student-centered techniques, motivated intrinsically to be a better teacher, and perhaps valued by their peers.
- A lack of change is likely motivated by a status quo bias.

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