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The Role of Theory in Instructional Design

Some Views of an ID Practitioner

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Editor's Note

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This article describes how an experienced instructional designer thinks about and uses learning theories to inform instructional design decisions. It uses a vision metaphor to provide a simple heuristic framework for identifying the nature of instructional problems and relating different types of problems to useful theoretical perspectives, methods of instructional analysis, and assessment strategies. Finally, it provides a synopsis of major learning theory perspectives and situations that could be addressed by applying models and strategies representing the different theoretical perspectives.

There has been considerable discussion in recent years about the role that learning theories play in instructional design practice (Wilson, 2005; Christensen & Osguthorpe, 2004; Reigeluth, 1999; Hannafin, Hannafin, Land, & Oliver, 1997; Bednar, Cunningham, Duffy, & Perry, 1992). Do instructional designers actually think about and apply the theories they learned in college? Are these theories really useful? In a recent survey of over 100 instructional designers, about half of the designers indicated that they regularly use specific learning or instructional theories or research to make instructional strategy decisions (Christensen & Osguthorpe, 2004). This study did not reveal, however, when and how instructional practitioners use these theories. What theories do they think about? How do they think about the theories? Do they use more than one theory at a time? How do they use these theories to inform their decisions? After almost 25 years of instructional design practice, I have developed some ways of thinking about learning theories that have proven useful for me. I have shared these ideas with students and other designers over the years, and many have found them helpful. I share them here as a type of think-aloud exercise, not to claim they are the only way to think about and apply theory to instructional practice but as a type of heuristic that might help novice designers. I encourage other experienced practitioners to reflect on and record their strategies for applying theory to practice as a means of documenting and comparing best practices.

When I design instruction, I do not usually start with a particular theory. My main focus is the problem and the problem situation. I start by considering the nature of the instructional problem and then ask: “What theory or models would be most useful and appropriate to help address this problem?” Deciding on a theoretical perspective early in the design process not only helps later when it comes to designing the instruction, but also serves as a guide for deciding how to analyze the learning tasks or content and how to assess learning.

What Is the Nature of the Problem?

I have found it useful to use a vision metaphor when considering the nature of instructional problems. I decided on this metaphor because I am very conscious of vision issues since I have poor eyesight and come from a family of eye doctors. One time I visited my eye-doctor brother for help with my worsening vision. In the process of discussing what would be the best solution for my problems, he mentioned that he is continually confronted with a range of trade-offs and alternatives when trying to come up with the most appropriate prescription for his patients. He described one occasion when a woman walked into his office with a thread and needle and simply stated, “Doctor, I want glasses that will help me thread this needle.” That was all she seemed to care about. She had specific and measurable criteria for the solution, and in no time he was able to determine the most appropriate prescription for her.

My brother admitted that these kinds of cases are the most straightforward to solve. But most often he must devise an all-purpose prescription that will allow his patients to perform in many situations—some known, but most of them unknown. This is when it is more difficult to determine the appropriate solution. It is usually less clear in these cases what the optimal solution should be because it is impossible to evaluate the adequacy of the prescription in all the potential situations where the glasses may be needed.

I often think of instructional problems according to the continuum shown in Figure 1. On one end of the continuum are problems that are usually fairly easy to describe: the nature of the task can be defined, and the conditions under which it must be performed can be specified. I call these training problems. On the other end of the continuum are the problems that may require a more all-purpose prescription, where it is not possible to define or anticipate all the task requirements or the conditions under which the tasks may need to be performed. I refer to these types of problems as education problems. The importance of evaluating the overall goal or nature of an instructional problem at the outset should not be underestimated. Other designers have advocated a similar strategy. For instance, Wilson, Teslow, and Osman-Jouchaoux (1995) advise:

Distinguish between educational and training goals. Acknowledge that education and training goals arise in every setting. Schools train as well as educate; and workers must be educated—not just trained in skills— to work effectively on the factory floor. Discerning different learning goals in every setting provides a basis for appropriate instructional strategies. (p. 149)

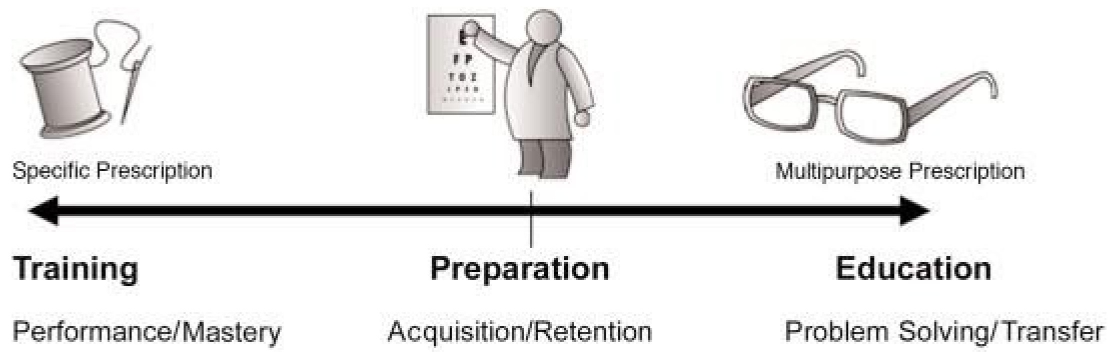
I refer to the middle of the instructional problem continuum as the preparation domain. Problems that fall near the center are not as focused or easily measured as the training problems, but they still represent more readily definable ranges of needs than the education problems. For example, using the vision metaphor, if someone came to the doctor and asked for help passing the driver’s vision exam so that she would later be able to drive, that would be a preparation problem. Preparation problems represent an intermediate range of goals—ones that may be necessary to achieve the more application-oriented ends of training and education. Preparation goals undergird or provide critical prerequisite skills or knowledge for training and education. Clearly many instructional problems have elements of all of these instructional goals, but I try to identify the overriding goal, the goal with the highest priority, in the problem situation I am addressing. This helps me focus and optimize my efforts throughout the remaining design process.

How Does Learning Theory Relate to the Different Types of Problems?

It is important to remember that unlike the field of physics, which has been fairly successful in finding unifying theories to help guide work in that area, there is no one unifying theory of learning or instruction. Many theories have been devised over the years, with varying degrees of success in guiding practice. As these theories prove inadequate to explain or help with some types of learning, they usually fall out of favor. This is just what Thomas Kuhn (1996) in his famous treatise, The Structure of Scientific Revolutions, would predict. Most often there is a current favorite theory or paradigm that guides practice in education. However, we should not be so eager to use a particular theory just for the sake of being current. We may be ignoring or overlooking some effective and important strategies for the situation at hand. Many of the earlier learning paradigms and theories (e.g., behaviorism) are still useful for certain types of learning problems.

Figure 1

Continuum of Instruction Problems



Many theories and models of learning and instruction have been developed over the years—so many that it is often difficult to assimilate and remember them all, let alone use them to help guide instructional practice. Fortunately, some educational psychologists group these theories and practices into three or four main categories. For instance, Ormrod (2008) categorizes learning theories according to three main perspectives of learning: cognitive psychology, behaviorism, and social cognitive theory. Woolfolk (2007) describes four main views of learning: behavioral, information processing, psychological/individual constructivist, and social/situated constructivist views.

Figure 2 summarizes my synthesis of different learning theory perspectives as they relate to instructional design and metaphors that I have found useful. The figure also lists assumptions regarding the nature of knowledge underlying each perspective, as well as the role of the instruction, the role of the learner, and the main instructional and motivational strategies suggested by these perspectives. When reading about a new idea or model, I ask myself, "What are the assumptions underlying this model, and where would it fit under these major theoretical perspectives?" Finally, I ask, "Does this theory or model reveal a useful new idea that distinguishes it from others?" Then I try to remember that idea so I can apply it in my designs if appropriate.

Figure 3 shows the theoretical perspectives that seem to have the most to say about each type of problem. Training problems, as I have defined them, represent more limited, specific behaviors or tasks to be completed under definable conditions. Therefore, many of the strategies underlying behaviorism are still very useful to help address these types of problems. In addition, some aspects of social cognitive theories (e.g., Bandura, 1986), such as vicarious reinforcement and modeling, can be useful to address many training problems. Learners benefit from seeing others model specific tasks or behaviors and noting the consequences of correct or incorrect actions.

Figure 2

Major Learning Theory Perspectives and IImplications for Instructional Design

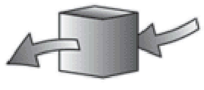
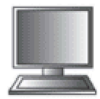
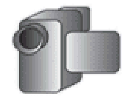
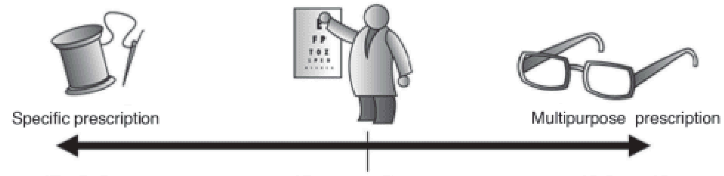
	Behaviorism	Information Processing	Social Cognitive	Constructivism: Cognitive	Constructivism: Social
Main Metaphor	 The black box—focuses on inputs and outputs (behaviors); not worried about what is happening inside	 The computer—focuses on how information is processed, stored, and retrieved from memory	 The video camera—focuses on effects of personal observations on behavior and cognitive processes	 The rhizome—focuses on rootlike (unlimited) growth and development through interaction with environment and others (Driscoll, 2005, p. 388)	
Nature of knowledge	Knowledge is "out there" and needs to be acquired and used	Knowledge is "out there" and needs to be acquired by connecting it to knowledge already stored "inside"	Knowledge is negotiated from experience and reason	Knowledge is individually constructed through interaction with the environment and others	Knowledge is coconstructed through interaction with others
Role of the learner	Performer—acquires and demonstrates use of knowledge	Processor—uses strategies to acquire, retrieve, and use information	Observer/copier—learns by observing others	Explorer—interacts with the environment and others to make individual discoveries	Collaborator—creates meaning through social negotiation, interaction, and cooperation
Role of instruction	Convey knowledge and change behavior by managing and supervising the learning environment	Transmit knowledge by guiding students toward an "accurate" acquisition of knowledge	Model and reinforce behaviors to help students set and achieve meaningful goals	Provide experiences and resources so students gain personal understanding	Provide meaningful social contexts for coconstructing knowledge
Main instructional strategies	Define behaviors Provide practice opportunities Correct mistakes (consequences, feedback)	Organize and present information Demonstrate strategies Manage memory load Identify and correct misconceptions	Model and reinforce behaviors (directly and vicariously) Help set personal goals Show how to monitor own behaviors	Create "puzzlement" Provide opportunities to experiment and articulate ideas	Create a social learning environment Provide opportunities to interact and articulate thinking
Main motivational strategies	Provide positive (or negative) reinforcement—use rewards or disincentives to shape behavior	Make connections with prior knowledge and experience (schemas)	Encourage belief in self (self-efficacy) through direct and vicarious reinforcement; set personal goals and monitor progress (self-regulation)	Stimulate interest or curiosity in an anomaly	Create authentic, inherently challenging situations

Figure 3

Instruction Problem Types and Related Goals, Theoretical Perspectives, Types of Instructional Analysis, and Assessment Strategies

Instructional Problems



	Training	Preparation	Education
Goals	Performance/ mastery	Acquisition/retention	Problem solving/transfer
Useful theoretical perspectives	Behaviorism Social cognitive (vicarious learning)	Information processing Social cognitive (modeling)	Constructivism: cognitive, social Social cognitive (self-regulation)
Type of instructional analysis	Job analysis, procedural analysis, skill analysis	Content analysis, learning analysis	Cognitive task analysis, activity analysis
Assessment strategies	Performance assessment or mastery tests	Domain-referenced tests	Alternative assessments, including portfolio assessment, holistic scoring, authentic assessments

Many preparation problems may be addressed by strategies suggested by an information-processing perspective that focuses on the capabilities and limitations of human memory and cognitive processes. These theories (e.g., Norman, 1982) suggest strategies for presenting and chunking information for optimal encoding and retrieval, assimilating new information into existing schemas, and encouraging and enhancing meaningful learning. In addition, as social cognitive theory suggests, learners may benefit from having others model how to apply effective learning strategies for remembering, understanding, and extending ideas.

Constructivist approaches, both cognitive and social, provide strategies for addressing many education problems. They suggest ways of helping learners develop expertise and problem-solving skills to function effectively in complex, social, unpredictable, and nuanced real-world environments. In addition, education problems may be addressed by emphasizing aspects of social cognitive theory that focus on strategies for helping students become self-regulated learners—able to define problems effectively, identify possible solutions, predict consequences, choose best solutions, identify how to carry out the solution, implement solutions, and evaluate results (Bandura, 1986).

To some, this high-level synopsis may sound like a gross overgeneralization, but it helps me address a vast and complex array of theories, models, and strategies. This high-level approach is just a heuristic. When I design, I still may draw from multiple theories or perspectives to address a particular problem. For instance, I might decide to use a particular social constructivist strategy such as team-based learning (Michaelsen, Knight, & Fink, 2004) as my main strategy to help students learn to solve real-world problems by coconstructing knowledge as learning teams. But in the process of implementing this approach, I might also incorporate the use of incentives, such as posting team scores or giving extra points for exceptional team performance, motivational strategies derived from behaviorist theories.

How Do the Theoretical Perspectives and Problem Types Guide My Design?

It is important to remember that there is no formula for great design. By definition, this is a problem-solving process that cannot be described step-by-step. Nevertheless, Figure 3 summarizes what I think the major theoretical perspectives and learning goals generally imply for the type of assessment strategies and analysis techniques most appropriate for each problem type. The instructional analysis strategies listed—job, procedural, and skill analysis; content analysis; learning analysis; cognitive task analysis; and activity analysis—reflect the main categories of analysis outlined by Jonassen, Tessmer, and Hannum (1999). Job, procedural, and skill analyses are frequently the best approaches to use for training problems because they involve creating specific task, skill, or procedural descriptions as they relate to an organizational context or larger system. For preparation problems, content and learning analyses, which focus on hierarchical relationships among concepts, principles, tasks, or behaviors, are useful strategies for analyzing content or skill domains that may be prerequisites to training or problem-solving tasks. These approaches focus more on ways of representing content for optimal retention and retrieval rather than sequencing tasks for actual performance. Finally, cognitive task analysis (CTA) techniques and strategies are best suited to capture the explicit and implicit knowledge that experts use to perform complex tasks (Clark, Feldon, van Merriënboer, Yates, & Early, 2007). CTA is often used to create expert systems and complex simulations. In addition, activity analysis, based on activity theory, is frequently used to analyze education problems. Activity analysis focuses on understanding the rich contexts in which people live and work; it is used to examine the activities in which experts engage, the tools they use, and the social context and interrelationships among participants in real-world environments (Jonassen et al., 1999).

Thinking in terms of the instructional problem continuum shown in Figure 3 also helps to identify useful assessment strategies. Training problems generally lend themselves to performance assessment or mastery-testing strategies. Performance assessment "is assessment based on observation and judgment" (Stiggins, Arter, Chappuis, & Chappuis, 2004, p. 191). The main goal in using performance assessment is to describe a skill or task and the criteria that will be used to judge the performance. This type of assessment may use checklists, rating scales, or rubrics to measure achievement or mastery.

Since it is often not practical or even possible to test mastery of large areas of underlying content knowledge or expertise, preparation problems are frequently assessed by sampling from a domain of potential terms, concepts, and principles that represent critical content underlying an area of study. This approach is sometimes referred to as domain-referenced assessment. According to the technical definition, domain-referenced assessment "requires the specification of rules that determine membership in the domain and a procedure for sampling individual elements so that inferences can be made from the sample to the domain" (Gipps, 1994, p. 82). I use this term more loosely to describe an attempt to sample from a content domain by using a table of specifications or other forms of systematic analysis to represent critical content in an area of study. Typically, domain-referenced assessment uses standard written test item formats, such as multiple-choice, true-false, or short-answer questions, to test learner knowledge or understanding. Finally, education problems lend themselves to alternative forms of assessment, including holistic assessments, or portfolio or authentic assessments, where the goal is to measure the application of principles and concepts through the production of outcomes or performance of behaviors in realistic, complex settings.

To illustrate how the three main problem categories I have defined could be applied to different settings and situations, Table 1 shows how I might use the problem types to categorize representative situations, examples, and instructional models.

Table 1	Example Situations, Applications, and Models Related to Different Types of Instructional Problems		
	Types of Instructional Problems		
	Training	Preparation	Education

When to use	To improve performance on a specific job or task To know or learn skills to achieve mastery To know how to use a new product, process, or skill to some required level of mastery or proficiency To achieve automaticity in a critical skill	To gain fluency in the vocabulary, concepts, skills, and strategies of a particular subject area To promote in-depth understanding of a subject matter or content domain To acquire critical prerequisite concepts necessary for performing a job or pursuing a profession To provide needed background knowledge for completing a task or solving a problem	To know how and when to apply content or process knowledge under differing circumstances To be able to solve a variety of unique problems To learn how to work cooperatively to solve problems in a given area
Examples	To learn • The features and functions of a new computer program • How to handle a new machine • The steps of a new development process	To learn about • Human anatomy in preparation for a health care profession • Different types of computer networks to become a systems analyst • Various learning theories to become an educator • Mathematical concepts and principles in preparation for a science career	To learn • How to diagnose a disease • How to conduct a technical systems analysis for a large corporation • How to apply principles of physics to daily life
Useful teaching or instructional models	Bloom's mastery learning model (Bloom, 1976) Programmed instruction (Skinner, 1968) Personalized systems of instruction (Keller, 1968)	Ausubel's meaningful reception learning (1978) Gagné's theory of instruction (1985)	Cognitive • Discovery learning (Bruner, 1966) Social • Cognitive apprenticeship (Collins, Brown, & Newman, 1989) • Goal-based scenarios (Schank, 1992) • Problem-based learning (Savery & Duffy, 1995) • Team-based learning (Michaelsen et al., 2004) • Service-learning (Campus Compact, 2003)

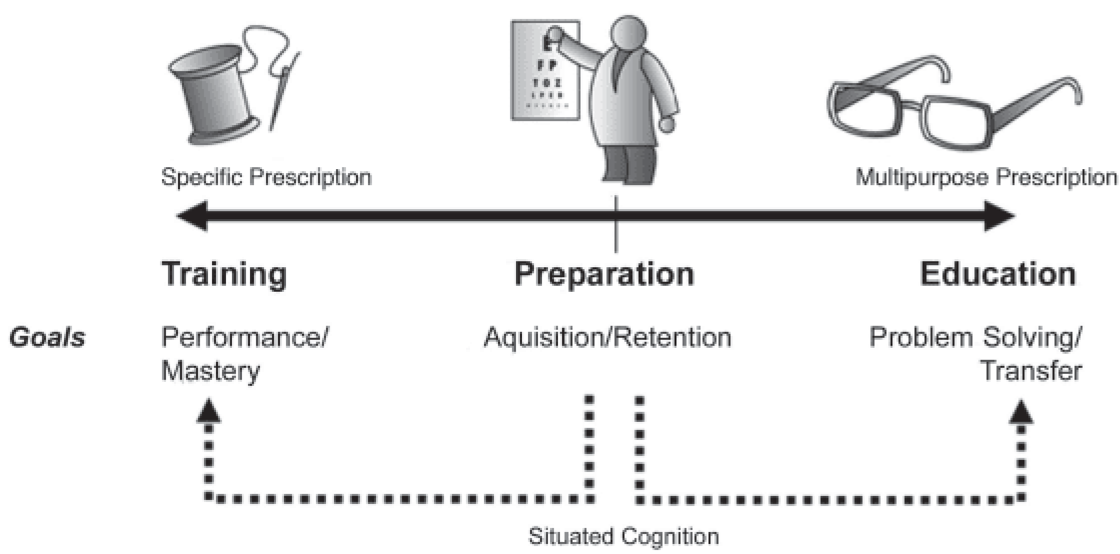
When Might It be Useful to Combine Approaches?

Now that I have differentiated problem types and theoretical approaches, I want to highlight a connective thread that has emerged in recent years to help me tie these approaches together when circumstances allow. The emphasis on situated cognition (Wilson & Myers, 2000) proposed by social-constructivist approaches to learning has implications for combining strategies from the different learning perspectives. Situated cognition suggests that learning should be taking place in the context in which it is used. Therefore, when I am creating learning environments to address educational needs, I try to find ways of incorporating preparation activities into the setting where the problem solving takes place. Strategies for accomplishing this goal include using simulations, apprenticeships, internships, service-learning, and other approaches. The implication of this perspective for both training and educational goals has also led to an emphasis on work-based, just-in-time learning. With the increasing speed and accessibility of electronic media, this notion has become the basis of a new field emphasizing the design and development of electronic performance support systems (Gery, 1991). Whenever possible, I watch for opportunities to use an electronic performance support system or even non-electronic job aids to help learners achieve preparation objectives in training and educational contexts.

If I were to show the implications of situated cognition on the problem continuum, I would show more preparation goals being addressed at the ends of the continuum in the performance contexts, as illustrated by Figure 4. This means learners would have ready access to important supporting skills or knowledge in the same context where they are performing the training task or trying to solve problems.

Figure 4

Situated Cognition and the Problem Continuum



Summary and Implications for Practice

In summary, I use learning theory to guide design by first deciding on the nature of the instructional problem and the main goal of the instruction. Then I decide which theoretical perspective or perspectives best match the needs of the situation. Next, I often investigate specific teaching models that reflect the theoretical perspectives I have determined are most useful and appropriate for addressing the problem. I may apply a particular model or simply rely on basic strategies related to the different theoretical perspectives to help guide, inform, and justify my design. I also watch for opportunities to use technology to help support and achieve preparation goals in performance contexts. HPT professionals who use this type of process can balance instructional decisions with the time, cost, and contextual constraints of the situation.

In reflecting on the use of theory in instructional design practice, I tend to concur with Wilson and Myers's (2000) assessment of the way practitioners generally use theory:

> *Most clinical psychologists are reportedly "eclectic" in their stance towards the various theories of psychotherapy. Many teachers and instructional designers take the same non-committal stance toward theory. They prefer a menu or toolbox metaphor instead of an application/consistency metaphor. Practitioners tend to be opportunistic with respect to different theoretical conceptions. This stance toward theory might be termed "eclectic" or "grab-bag," but we prefer to think of it as problem- or practitioner-centered. People rather than ideologies are in control. The needs of the situation rise above the dictates of rules, models, or even standard values. (p. 82)*

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