Chapter Eleven

The Impact of Constructivism (and Postmodernism) on ID Fundamentals

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Abstract

The constructivist movement is changing the way many of us think about instructional design (ID), but theorists are still somewhat vague about actual design practices. A certain fuzziness may be inevitable, since constructivism is a broad theoretical framework, not a specific model of design. Moreover, constructivism tends to celebrate complexity and multiple perspectives. Still, for constructivism to have a meaningful influence on ID, we must build a bridge to practice. This chapter addresses some of the practical concerns of instructional designers who ask about the implications of constructivist theory for their work. After laying a theoretical framework, we offer a set of guidelines for revising ID practice. We show how constructivist ideas can be incorporated into the ID process without totally disrupting the management and quality-control functions of traditional models.

Chapter Objectives

After reading this chapter, you should be able to:

- define "constructivism" and "postmodernism";
- identify differences between traditional and constructivist approaches to ID;
- identify and appreciate new approaches to ID that incorporate constructivist ideas.

Chapter Quiz

Quick—before continuing—please answer the following questions:

True or False 1. The objectives listed above are operational descriptions of the behaviors you will be able to exhibit after reading the chapter.

True or False 2. The objectives above accurately capture the richness of the content found in the chapter.

True or False 3. Placing objectives at the beginning of a chapter is a violation of constructivist principles.

Answer Key to Chapter Quiz

Here are ~~the/some~~/*our* answers to the questions on the quiz:

False 1. *The objectives listed above are operational descriptions of the behaviors you will be able to exhibit after reading the chapter.* Who knows how this chapter will change your behavior? While the objectives are written in the familiar, behavioral form, we have included them to serve as an advance organizer to cue our readers to the goals of the chapter. It's a stretch to say they are "operational descriptions" of anything. Certainly they had no bearing on the chapter's design, since they were written after the chapter was mostly done.

False 2. *The objectives above accurately capture the complete richness of the content found in the chapter.* Of course not; even diehard objectivists would not pretend that objectives reflect 100% of the content. The trouble is, we tend to forget that fact. We treat objectives *as if* they were the end-all, be-all. Defining and meeting objectives can be useful activities but are no cause for rejoicing in heaven.

False 3. *Placing learning objectives at the beginning of a chapter is a violation of constructivist principles.* Who said so? Such cues can focus attention on text information; why can't we use objectives if they help learners make sense of instructional material? We are not so much concerned with a particular strategy that you might use but with your stance toward the strategy and toward the content. More on this later.

Bonus question:

True or False 4. *Writing in this informal, smart-alecky tone is typically postmodern.* True. Reacting against the pretensions of objectivity of traditional science, many postmodern authors write in more direct, personal terms. For the remainder of this chapter, we mitigate our tone somewhat; even so, the style is more personal than that of most published work in instructional design.

Why Constructivism Is a Hot (and Faddish) Topic

In the last 30 years, virtually every social science and field of humanities has moved away from rationalistic, linear ways of thinking towards an appreciation of multiple perspectives and reasoning in context (Tarnas, 1991). The constructivist movement in ID reflects this trend. Instructional designers are adapting more flexible models and tools and more comprehensive ways of thinking about learning and instruction. Two seminal issues of *Educational Technology* (May and September 1991) were devoted to constructivism; another issue (March 1993) dealt with situated learning. More recently, a special issue was devoted to postmodern topics (February 1994). ID's attempts to grapple with change, including the expected overstatements of positions and resistance from the Old Guard, are borne out in those *Ed Tech* issues.

The struggle between competing paradigms also reveals itself in the defensive humor aimed at the new buzz words—jokes, for example, about "post-postmodernism" or "deconstructivist ID." In the face of constructivism, many theorists and practitioners feel less secure about the validity of models they learned long ago in graduate school. The humor also pokes fun at the faddish, bandwagon effect accompanying any major change in a field. Clearly, some people can go overboard with every new idea that comes along, just as others stubbornly cling to methods that have lost their usefulness.

Still, a puzzle remains. The literature on constructivism is filled with theoretical dialogue but few design models or concrete suggestions for practice. On reflection, constructivists may be reluctant to address such issues for several reasons:

- Constructivists tend to avoid simple recipes and cookie-cutter formulas for practicing their profession. "There are no simple answers to design," they say, "so quit asking for the end-all, be-all model—just do it."
- Constructivists are not "system builders" in the grand tradition of Newton, Hegel, Skinner, or Freud. Instead, constructivists tend to see knowledge as connected to practice and as context-dependent. Their "theories" are more localized, partial, and tentative. Being slightly anarchistic, some constructivist designers might claim to be too busy doing design and less interested in formalizing their ideas into academic papers.
- Constructivism is a philosophy or way of thinking about design, not a specific approach to design. So constructivists should be able to adapt traditional models and instructional strategies to their designs.

We acknowledge these points, but, taken together, they still add up to something of a cop-out. Theory that doesn't connect to practice will not result in better designed instruction.

In this chapter we seek to address the practical, everyday concerns of instructional designers. We offer a guided tour through the world of constructivist thinking. After some theoretical background, we show how a constructivist approach to ID seeks to combine the project-management and quality-control features of current development models with flexible practices that are sensitive to learner, content, and context differences. Next, for each phase of a traditional ID process, we offer a set of revisionist guidelines for practice.

Please remember that labels such as "constructivist" or "postmodern" embrace a whole range of ideas and methods. This chapter is our best shot at concretizing a philosophy, yet we claim no authority or right to speak for constructivists as a group[1]. In the coming years, we expect that numerous models and strategies will be offered by

[1]Some postmodernists would argue that our attempt to be simple and direct in this chapter is reductionistic and does violence to the beautiful complexity of the issues. While we want to maintain a sense of playfulness or mischief, as do many postmodern writers, we hope to express our ideas as clearly as possible. We believe there is a time and place for clarity in theoretical discussions, as well as in instruction.

constructivist designers, no doubt differing substantially from our discussion here.

Theoretical Background

Constructivism. Constructivism is fairly hard to nail down because the label covers a wide spectrum of beliefs about cognition (Jonassen, 1991). Traditional constructivists, followers of Piaget, emphasized individual thinking and creation of meaning (e.g., Forman & Pufall, 1988). New-style constructivism may never mention Piaget while incorporating more ideas about culture and social learning. David Merrill (1991), while not sharing constructivist beliefs, does a good job of defining constructivism as it relates to instruction:

- Knowledge is constructed from experience.
- Learning is a personal interpretation of the world.
- Learning is an active process of meaning-making based on experience.
- Learning is collaborative with meaning negotiated from multiple perspectives.
- Learning should occur (or be "situated") in realistic settings.
- Testing should be integrated with the task, not a separate activity.

We might also add the following points:

- Reflection is a key component of learning to become an expert.
- Like instruction, assessment should be based on multiple perspectives.
- Learners should participate in establishing goals, tasks, and methods of instruction and assessment.

In general, constructivism tends to be more holistic and less mechanistic than traditional information-processing theories (Cunningham, 1991). People make sense out of their world by taking in information from the environment and assimilating it into their pre-existing schemas and understandings (Bransford & Vye, 1989). Learners undergo conceptual change by directly confronting misconceptions (Wilson & Cole, 1991a). Some constructivists have aligned themselves with the situated cognition movement (Brown, Collins, & Duguid, 1989), asserting that because cognition depends on our experience base, cognitive apprenticeships and other authentic teaching methods are preferable (Clancey, 1992).

The roots of many constructivist beliefs are traceable to post-modern philosophies which depart from the rationalist, objectivist, and technocratic tendencies of "modern" society. Table 11.1 illustrates

Table 11.1. Constructivism and its underlying epistemology.

Underlying Epistemology	Theoretical Framework
Postmodernism Postmodern philosophy emphasizes contextual construction of meaning and the validity of multiple perspectives. Key ideas include: • Knowledge is constructed by people and groups of people. • Reality is multiperspectival. • Truth is grounded in everyday life and social relations. • Life is a text; thinking is an interpretive act. • Facts and values are inseparable. • Science and all other human activities are value-laden.	**Constructivism** —Mind is real. Mental events are worthy of study. —Knowledge resides in the mind. —Knowledge is dynamic. —Meaning is constructed. —Reflection/abstraction is critical to expert performance and to becoming an expert. —Learning includes constructing representations. —Teaching is negotiating construction of meaning. —Thinking and perception are inseparable. —Problem solving is central to cognition.

this relationship between constructivism and an underlying postmodern epistemology[2].

Postmodernism. Hlynka and Yeaman (1992) list the defining characteristics of postmodernity as "plurality, ironic double-coding, critique of meta-narratives, and recognition that if there are multiple ways of knowing then there must be multiple truths" (p. 1). They characterize postmodern educational technology by these features:

- A belief in pluralism.
- An emphasis on criticism rather than evaluation.
- A focus on constantly rethinking our beliefs, tools, and technology. (p. 2)

[2]Because of space constraints, our discussion of postmodern concepts is necessarily limited. We also recognize that not every expression of constructivism reflects a postmodern sensibility. Even so, our tack on constructivism is definitely postmodern, using the terms almost interchangeably at certain points. For a more thorough discussion of postmodernism and its relationship to constructivism, see Wilson (in press, b).

Clearly, recent models of cognition are challenging traditional notions of learning and teaching. For those of us raised on objectivist models of mind, however, old habits die hard. Difficulties include:

1. It seems only intuitive to think that the *real* world is *out there* and that our minds are merely trying to capture it. Postmodern philosophy rejects the traditional dualism of mind vs. body, inner vs. outer, ideal versus real. Rethinking from a holistic perspective takes some getting used to.
2. Many people feel more secure thinking of their disciplines as clearly and explicitly defined by a clear set of rules and systematic principles. Coming to see scientific knowledge as dynamic, partial, and value-laden can be an adjustment.
3. We are fond of clearly differentiating "theory" from "practice," theory being where the knowledge resides and practice where that knowledge gets applied (see the discussion in Schön, 1987). Postmodern theorists suggest that practitioners use theories in practice, but that the theory-in-practice differs radically from the textbook theories.
4. Many of us are unaccustomed to considering the political, ethical, and value implications of our practice. We tend to think of "fact" and "value" as two separate spheres, with ID predominantly objective and factual.
5. Many designers see their role as controlling complexity and simplifying content for initial consumption by novices. Postmodern ID would change the emphasis to *managing* the complexity and helping novices find their way around it.

Despite these difficulties, we believe that constructivism can be compatible with many traditional forms of ID. However, from a constructivist stance, the *meaning* of ID activities changes.

An Outline of Constructivist ID

In this section we consider the nature of the design process and the need for constraints, then turn to issues of defining a design team.

Managing Constraints to Design

Consider what it means to design something (e.g., to fashion something from a well-developed plan). ID shares with all design activities the challenge of creating something that accomplishes a given purpose within the constraints and parameters of the situation. Constraints are a natural part of the creative design process, despite our yearnings for unlimited budgets, motivated learners, and relaxed

deadlines. The realities of the situation, the goals of instruction, and limited resources constitute the "raw material" from which effective designs can take shape (Wedman & Tessmer, 1991). Failure to consider key constraints and underlying functions of system components can result in the failure of a project.

On the other hand, ID sometimes imposes unnecessary constraints upon itself (Thiagarajan, 1976; Rowland, 1993). Is ID always served by a strictly linear methodology, a rigid taxonomy of learning outcomes, or a fixed pool of instructional strategies? Such internally imposed constraints can become an obstacle to creativity and an unnecessary burden to the practitioner and to learners. For example, rapid prototyping is an innovation that changes the sequence of design steps, allowing the designer to redefine ID processes to better suit the situation and the tools available. The trick, of course, is knowing which constraints are genuine and which can safely be discarded as new possibilities present themselves.

Traditional ID models succeed largely because they provide for the management of a team of workers engaged in a complex project. The critical management functions of monitoring work and ensuring accountability are handled by a set of management checkpoints or signoffs—with little regard for their impact on the design process itself. Indeed, management goals and design goals are often in tension with each other. For an ID model to work in the real world, it must combine these two critical functions into a workable methodology: effective creative design on the one hand and efficient management on the other, as illustrated in Table 11.2.

Because of the tension between these competing functions, one will often predominate over the other. If the management function is emphasized, the project may come in under budget, but tend toward mediocrity in strategy and the mundane in learning outcomes. If creative design dominates, the project may be pathbreaking but remain forever in a state of partial completion. Figure 11.1 illustrates this tension by reference to a hot air balloon trying to reach upward but being tethered down by a number of constraints—some real, some artificial. Ignore the constraints entirely, and project costs rise into the stratosphere. The point is that we need a balanced set of safeguards and constraints that assure careful design and accountability but which are flexible enough to allow the project to safely "fly."

Who Does the Design?

A key element in effective ID is the nature of the design team. Instead of a designer and subject expert working in relative isolation,

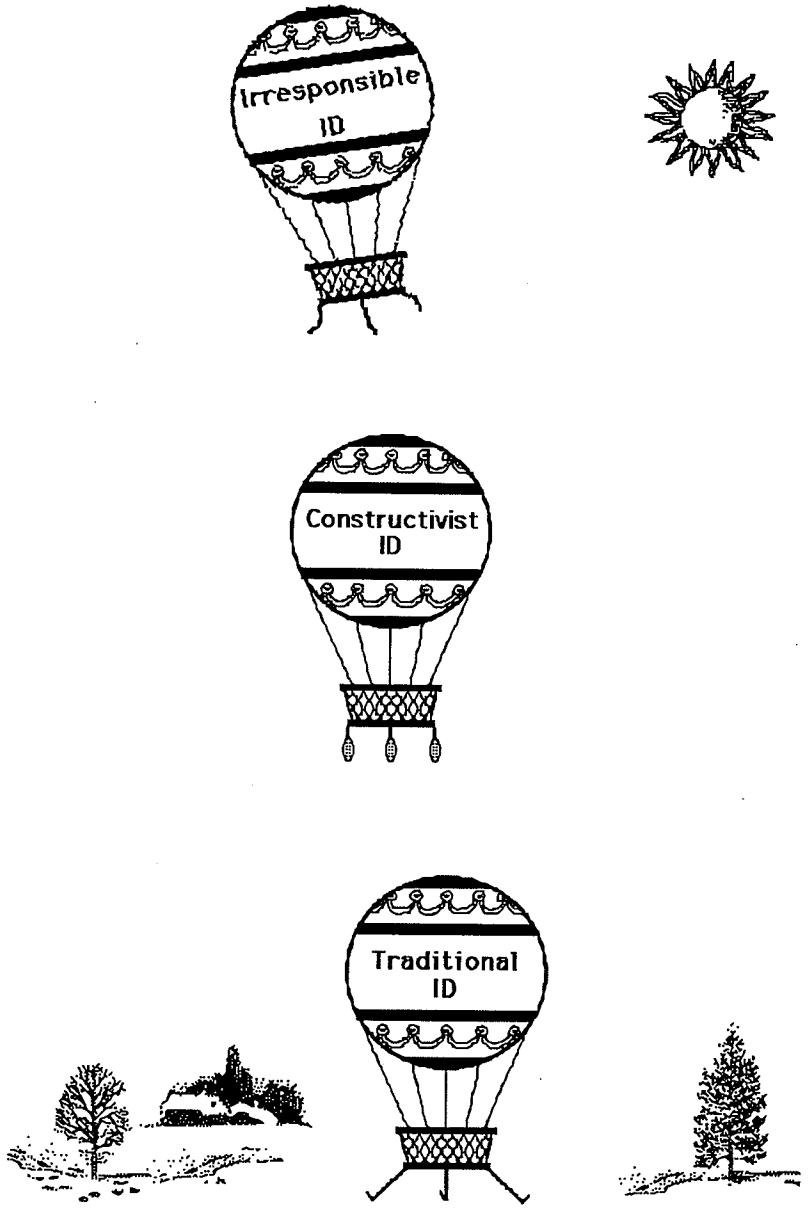

Figure 11.1. Design can have too few or too many constraints.

Table 11.2. Two competing functions of instructional design models.

Effective Creative Design	Efficient Management and Control
• What do the learners learn—really? • Are learners motivated by instruction? Do they see the value and relevance of instruction? • Do learners use their knowledge to solve problems in authentic performance settings? • Are learning environments rich in information, guidance, and support?	• Will the instructional product reflect a return on investment? • Is the development process efficient? Are resources being well utilized throughout the design process? • Is there systematic planning, decision-making, and accountability in the design process?

constructivist ID suggests that all major constituencies be represented on the design team, including teachers and students. These end users—the "consumers" of the instructional "product"—should contribute directly to the project's design and development. Greenbaum & Kyng (1991) refer to this as *participatory design*, and Clancey (1993) recommends "we must involve students, teachers, administrators, future employers, and the community as participants in design..., working with students and teachers in their setting—not just calling them into the...lab to work with us" (pp. 9, 20).

We can hear the comment now: "But we've always incorporated the end user in our ID models; this sounds like warmed-over formative evaluation." We respond: "If formative evaluation got done a tenth as much as it gets talked about, ID practice would be in much better shape." Still, constructivism takes old ideas and gives a new impetus to them. Consider the traditional roles of team members:

- *Subject matter expert (SME).* Provides the content and expertise.
- *Designer.* Figures out a way to extract (milk?) expertise from the SME and encode it into instructional materials. Selects instructional strategy appropriate to the content and the situation to effectively teach the content to the learner.

- *Teacher and student.* At formative evaluation stages, serve as subjects for tryout tests to maximize usability and learnability. At implementation stage, teachers and students take the instructional materials and carefully use them as directed. Something like a doctor's prescription.

Constructivism mixes up the roles much more. SMEs can help design learning experiences; designers manage projects, build teams, check for content accuracy, and serve as model learners and teachers. Teachers and students may help define or select content and design their own learning experiences. Poorly implemented, the redefinition and blurring of roles can lead to chaos and confusion; well implemented, a flexible team orientation can result in a synergy or a fusion of multiple perspectives that improves the design.

Accommodating Multiple Perspectives

In a pluralistic world, more flexibility must be built into the instruction; after all, even experts disagree on optimal solutions to problems. Not all students share the same learning goals; not all students' learning goals converge completely with instructional goals; students have different styles of learning, different background knowledge. Rather than ignore these differences, instruction should acknowledge the evolving nature of knowledge and encourage students to engage in a continuing search for improved understanding. This plurality of content, strategies, and perspectives typifies postmodern approaches to instruction.

Such a pluralistic approach to instruction follows a clear trend toward accommodating multiple goals, styles, and perspectives in instruction (Collins, 1991). But is pluralism the exception or the rule? What one views as "typical" may depend more on one's philosophical and value orientation than on any actual conditions found in schools and training environments. And that relates to a continuing theme of the chapter—constructivism is a theory about how things are, about what the mind is like; then, through the lens of that theory, one begins to see ID in new terms.

Guidelines for Doing Constructivist ID

This section is composed of a laundry list of tips for viewing ID from a constructivist perspective, organized according to generic ID phases. For scope reasons, issues of implementation are not addressed. Some of the tips are abstract and conceptual; others are simple and practical. Some depart radically from current practice;

others reflect how most practitioners already view their jobs. Collectively, they provide a clearer picture of what it means to do constructivist ID.

General Methodology

- *Apply a holistic/systemic design model that considers instructional factors (learner, task, setting, etc.) in increasing detail throughout the development process.* A number of key factors are systemically related in any instructional situation. Rather than doing a learner or task analysis once early in the process, return to these factors and their interactions continuously through the project cycle (see Wilson, Teslow, & Osman-Jouchoux, 1993, for an example).
- *Use fast-track* (Smith, Miles, Ragan, & McMichael, 1993) *or layers-of-need models* (Wedman & Tessmer, 1990). Adapt ID methodology to the constraints of a given situation. A single generic ID model is not appropriate for all situations. Identify key principles underlying ID methods—such as consideration of the learning environment—then use those principles in determining a procedures that fits the situation.
- *Include end users (both teachers and students) as part of the design team.* Incorporate participatory design techniques, with design activity moving out of the "lab" and into the field.
- *Use rapid prototyping techniques to model products at early stages.* Rapid prototyping is particularly useful in testing out the feasibility of innovative methods or user interfaces (see Tripp & Bichelmeyer, 1990).

Needs Assessment

- *Consider solutions that are closer to the performance context* (job aids, just-in-time training, performance support systems, etc.). This is consistent with situated models of cognition and with the notion of distributed cognition (Perkins, 1993).
- *Make use of consensus- and market-oriented needs assessment strategies, in addition to gap-oriented strategies.* Not all instruction is designed to improve performance in a specific work setting. Schools may develop curriculum based on a consensus among political constituencies.
- *Resist the temptation to be driven by easily measured and manipulated content.* Many important learning outcomes cannot be easily measured.

- *Ask: Who makes the rules about what constitutes a need? Are there other perspectives to consider? What (and whose) needs are being neglected?* These questions arise out of the postmodern notion of the ideological base of all human activity.

Goal/Task Analyses

- *Distinguish between educational and training situations and 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.
- *Use objectives as heuristics to guide design.* Don't always insist on operational performance descriptions which may constrain the learners' goals and achievement. Pushing goal statements to behavioral specifications can often be wasted work. The "intent" of instruction can be made clear by examining goal statements, learning activities, and assessment methods. Goals and objectives should be specific enough to serve as inputs to the design of assessments and instructional strategies.
- *Allow for multiple layers of objectives clustering around learning experiences.* Instruction need not be objectives-driven. A rich learning experience may embody a whole cluster of meaningful learning outcomes.
- *Don't expect to "capture" the content in your goal or task analysis.* Content on paper is not the expertise in a practitioner's head (even if you believed expertise resided in someone's head!). The best analysis always falls short of the mark. The only remedy is to design rich learning experiences where learners can pick up on their own the content missing between the gaps of analysis.
- *Allow for instruction and learning goals to emerge during instruction.* Just as content cannot be fully captured, learning goals cannot be fully pre-specified apart from the actual learning context. See Winn (1990) for a thorough discussion of this issue.
- *Consider multiple stages of expertise.* Expertise is usually thought of as having two levels: Expert or proficient performance and novice or initial performance. Of course, a two-level model is insufficient for accurate modeling of student growth over time. A series of qualitative models of expertise may be needed for modeling students' progression in learning critical tasks (White & Frederiksen, 1986). Be prepared to confront learners' naive, intuitive theories and to scaffold their learning.

- *Give priority to problem-solving, meaning-constructing learning goals.* Instead of rule-following, emphasize problem solving (which incorporates rule-following but is not limited to it). Instead of simple recall tasks, ask learners to make sense out of material and demonstrate their understanding of it.
- *Look for authentic, information-rich methods for representing content and assessing performance (e.g., audio, video).* High-resolution methods for representing content can be useful throughout the ID process. Whereas we usually associate audio and video representations only with *presentation* of material to students, the same representation tools may be useful for documenting expertise and assessing student understanding.
- *Define content in multiple ways. Use cases, stories, and patterns in addition to rules, principles, and procedures.* Rich cases, stories, and patterns of performance can be alternative metaphors for finding and representing content.
- *Appreciate the value-ladenness of all analysis.* Defining content is a political, ideological enterprise. Valuing one perspective means that other perspectives will be given less value. One approach is given prominence; another is neglected. Somebody wins, and somebody loses. Be sensitive to the value implications of your decisions.
- *Ask: Who makes the rules about what constitutes a legitimate learning goal? What learning goals are not being analyzed? What is the hidden agenda?* Twenty years ago, a designer using "understanding" in a learning objective would have been laughed out of the office. "Understanding" was fuzzy; it was forbidden. Are there other expressions of learning outcomes that remain taboo? Are there other dimensions of human performance that remain undervalued? Good postmodern ID would pursue answers to these questions and be unafraid of reexamining current practice.

Instructional Strategy Development

- *Distinguish between instructional goals and learners' goals; support learners in pursuing their own goals.* Ng and Bereiter (1991) distinguish between (1) task-completion goals or "hoop jumping," (2) instructional goals set by the system, and (3) personal knowledge-building goals set by the student. The three do not always converge. A student motivated by task-completion goals doesn't even consider learning, yet many students' behavior in schools is driven by performance requirements. Constructivist instruction would nourish and encourage pursuit of personal knowledge-building goals, while still supporting instructional goals. As Mark Twain put it: "I have never let my schooling interfere with my education."
- *Allow for multiple goals for different learners.* ID often includes the implicit assumption that instructional goals will be identical for all learners. This is sometimes necessary, but not always. Hypermedia learning environments almost by definition are designed to accommodate multiple learning goals. Even within traditional classrooms, technologies exist today for managing multiple learning goals (Collins, 1991).
- *Appreciate the interdependency of content and method.* Traditional design theory treats content and the method for teaching that content as orthogonally independent factors. Postmodern ID says you can't entirely separate the two. When you use a Socratic method, you are teaching something quite different than when you use worksheets and a posttest. Teaching concepts via a rule definition results in something different than teaching the concept via rich cases. Just as McLuhan discerned the confounding of "media" and "message," so designers must see how learning goals are not uniformly met by interchangeable instructional strategies (see Wilson, in press b).
- *Resist the temptation to "cover" material at shallow levels.* Constructivist ID may throw away half the ostensive "content" and focus on deeper learning of less material. This attitude is not unique to constructivism of course—programmed instruction theorists made a similar argument 30 years ago.
- *Look for opportunities to give guided control to the learner, encouraging development of metacognitive knowledge.* Encourage growth in students' metacognitive knowledge, what we often call "learning how to learn." Don't assume that students know how to exercise effective learning control; instead, establish metacognitive skills as a learning goal for instruction to achieve.
- *Allow for the "teaching moment."* Situations occur within instruction where the student is primed and ready to learn a significant new insight. Good teachers create conditions where such moments occur regularly, then they seize the moment and teach the lesson. This kind of flexibility requires a level of spontaneity and responsiveness not usually talked about in ID circles.

- *Consider constructivist teaching models such as cognitive apprenticeship, minimalist training, intentional learning environments, and case- or story-based instruction.* Seek out instructional strategies and systems that use authentic problems in collaborative, meaningful learning environments (see Wilson & Cole, 1991b, for examples).
- *Think in terms of designing learning environments rather than "selecting" instructional strategies.* Metaphors are important. Does the designer "select" a strategy or "design" a learning experience? Grabinger, Dunlap, and Heath (1993) provide design guidelines for what they call realistic environments for active learning (REAL); these guidelines reflect a constructivist orientation:

  Extend students' responsibility for their own learning.
  - —Allow students to determine what they need to learn.
  - —Enable students to manage their own learning activities.
  - —Enable students to contribute to each other's learning.
  - —Create a non-threatening setting for learning.
  - —Help students develop metacognitive awareness.

  Make learning meaningful.
  - —Make maximum use of existing knowledge.
  - —Anchor instruction in realistic settings.
  - —Provide multiple ways to learn content.

  Promote active knowledge construction.
  - —Use activities to promote higher level thinking.
  - —Encourage the review of multiple perspectives.
  - —Encourage creative and flexible problem solving.
  - —Provide a mechanism for students to present their learning.
- *Think of instruction as providing tools that teachers and students can use for learning; make these tools user-friendly.* This frame of mind is virtually the opposite of "teacher-proofing" instructional materials to assure uniform adherence to designers' use expectations. Instead, teachers and students are encouraged to make creative and intelligent use of instructional tools and resources.
- *Consider strategies that provide multiple perspectives and that encourage the learner to exercise responsibility.* Resist the temptation to "pre-package" everything. Let the learner generate his or her own questions or presentation forms.
- *Appreciate the value-ladenness of instructional strategies.* Sitting through a school board meeting is enough to convince anyone of this. Instructional strategies grow out of our philosophies of the world and our value systems. Not only the content, but the strategy can be a threat to particular ideological positions or to learner motivation. Good designers will be sensitive to the "fit" between their designs and the situation.

Media Selection

- *Consider media factors early in the design cycle.* Practical and cost constraints typically dictate that tentative media decisions will be made relatively early in the design process. Media then becomes one of the instructional factors that receives increasing attention through iterations of analysis.
- *Include media literacy and biases as a consideration in media decisions.* Different media send different "messages" to an audience, independently of the instructional content. Look for any "hidden curriculum" elements in different media choices. Avoid negative stereotypes and cultural biases. Consider the rhetorical goodness of fit between media choice and overall instructional purposes. Also, design messages that are sensitive to an audience's media sophistication and literacy, paying particular attention to humor, media conventions, and production values.

Student Assessment

- *Incorporate assessment into the teaching product where possible.* Technologies are available for incorporating continuous, "dynamic assessment" into learning materials (Lajoie & Lesgold, 1992). Assessment can then be seamlessly integrated into meaningful learning experiences and not tacked on at the end.
- *Critique and discuss products grounded in authentic contexts, including portfolios, projects, compositions, and performances.* Use of work products can complement more direct, traditional measures of knowledge acquisition and understanding (Cates, 1992). Include different perspectives in the critiquing process.
- *Evaluate processes as well as products.* The cognitive apprenticeship model offers a number of strategies for reflecting on process: debriefings, abstracted replays, dramatizations, interviews, group discussions, knowledge telling, co-investigation, and post-mortems of problem-solving activities (Collins & Brown, 1987; McLellan, 1993; Gay & Mazur, 1993).

- *Use informal assessments within classrooms and learning environments.* Informal assessments refer primarily to teacher observations of eye contact, body language, facial expressions, and work performance. These observations can complement formal assessments as a basis for instructional adjustments.

Expected Advantages of Constructivist ID

At this point, we should probably tout the advantages of following a constructivist model of design. Here is a list of possible advantages:

- more meaningful learning outcomes that are likely to be used in relevant contexts;
- more meaningful participation of the learner in the learning process;
- more independent problem-solving capability in students;
- more flexibility in design activities;
- more flexibility in instructional activities;
- more acknowledgment of social and motivational factors in learning.

Here are some possible risks:

- more costly instruction;
- greater need for instructional resources and information management;
- less coverage of material;
- less demonstration of specific skill mastery;
- chaos and confusion if poorly implemented.

The point is: (1) we really don't know all the pros and cons of new approaches, because we've never fully tried them out, and (2) as any constructivist would say, it depends on how it's done. There are good ways to do constructivism and bad ways, just as one can point to excellent and poor examples of training developed with an objectivist philosophy. We will learn more about the real pros and cons of doing constructivist design as more design models become available and as they become more widely used.

Conclusion

Instructional implications of constructivist and postmodern approaches have not yet been thoroughly worked through (Wilson, in press a & b). At a time of such basic re-thinking about the nature of cognition, it is hard to be dogmatic about what teaching strategies comprise the "optimal" design in any subject matter. Perhaps the main lesson for now is that the discussion should be followed with a certain degree of skepticism, with an eye toward implications for professional practice. Our knowledge base in cognition and instructional design really is fragile, depending on a shifting foundation that will likely continue to change in the years to come.

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