

# The Real World on a Short Leash: The (Mis)Application of Constructivism to the Design of Educational Technology

☐ Joseph Petraglia

*Constructivism, or more precisely, a constructivist metatheory, presently prevails throughout professional education circles. Most educators easily accept constructivism's central premise that learners approach tasks with prior knowledge and expectations based on their knowledge of the world around them. Naturally, then, constructivist educational technologists have been guided by the implicit (and increasingly explicit) desire to create "authentic" environments for learning: environments that correspond to the real world. In this paper, I argue that technologists have tended to paper over the critical epistemological dimension of constructivism by "preauthenticating" learning environments: creating environments that are predetermined to reflect the real world even though constructivist theory contrindicates precisely this. I suggest that a rhetorical perspective on constructivism offers a way out of this bind and I propose some guidelines to assist developers of educational technologies in accommodating the essentially dialogic nature of teaching and learning.*

☐ Unlike earlier efforts to motivate students by making learning relevant, today's educators are facing a much weightier challenge. Renewed interest in various threads of constructivism, such as the movement to situate cognition, has sparked a lively debate on the differences between thinking and learning in formal and laboratory settings as opposed to learning within more informal, everyday contexts. This more rigorous interest in *authentic* learning has been watched closely by educational technologists who have been working to apply the lessons of constructivism to the task of contextualizing pedagogy.

In this article, I will argue that educational technologists have fundamentally misunderstood the challenges posed by constructivism. This is seen in an approach to contextualizing learning that I call *preauthentication,* or the attempt to make learning materials and environments correspond to the real world prior to the learner's interaction with them. Preauthentication allows technologists to employ constructivistic rules-of-thumb to justify this or that learning environment, but ignores the epistemological dimension constructivism brings with it. I further argue that careful consideration of constructivism's epistemological implications suggests that we need to *convince* learners of a problem's authenticity rather than to promote environments that deliver preauthenticated problems. Therefore, I conclude that the goal of authenticating learning requires a look best afforded by the discipline of rhetoric: the study of persuasion and argumentation.

## CONSTRUCTIVISM AND THE TECHNOLOGIES OF AUTHENTICITY

Although its roots lie in Deweyan progressivism, an interest in authentic learning has received an enormous theoretical boost from the movement within educational circles in psychology to situate cognition. This movement is a response to dissatisfaction with cognitive psychology's information-processing paradigm (IPP) which chose, primarily for methodological reasons, to view thinking as largely independent of situational variables. The educational research derived from the IPP had concentrated on the cognition of individuals in highly artificial situations, deprived of the cues that prompt problem solving in everyday life. Resnick (1990) argues that, unlike the artificiality of the classroom, everyday situations permit—even demand—shared cognition (i.e., group problem solving), reliance on external tools and resources, and a much greater emphasis on the manipulation of objects rather than abstractions. Greeno (1989) has pointed out that traditional studies of problem solving and decision making have ignored the importance of personal approaches toward knowledge and learning in performing cognitive tasks. He joins many others in concluding that the formal context in which much education research takes place has contributed to creating a rarefied model of thinking that has little generalizability to thinking as it occurs in the real world.

In contrast, constructivists have argued that everyday learning always takes place within a social context (or what sociohistoricists have called an *activity system*). As Clark (1995) has concluded, "when students interpret an activity or an activity-situation as unrealistic and nonmeaningful, encoding, representation, and learning are likely to become reductified and narrowly school-focused. Full contextualization combats such tendencies; students realize that complex, multidimensional problems are much more endemic to real-world activity and that flatly unidimensional problem-situations exist only in school environments" (p. 259). For this reason, constructivism (or more accurately, a constructivist metatheory that draws together learning theories derived from Dewey (1938), Piaget (1970), Vygotsky (1962) and their contemporary interpreters) provides an empirical basis for viewing learning as intimately linked to the way learners function within quotidian contexts. Dunn (1994) encapsulates the guiding principle for many technologists when he concludes that ". . . instruction should take place in rich contexts that reflect the real world and are as closely related as possible to contexts in which this knowledge would subsequently be used. . . In a word, [contexts for learning] need to be authentic" (p. 84).

### Mediating Theories

Several theories mediating between constructivist psychology, on one hand, and constructivist pedagogy, on the other, have emerged. For educational technologists, the most central of these might be theories of collaborative learning, apprenticeship, and cognitive flexibility. It may be useful to discuss these theories briefly before addressing the issue of how technologists have attempted to accommodate authenticity in their design of learning environments.

*Collaborative learning.* A common response to the idea that knowledge is situated in social activities is that students should be encouraged to work with others. As the Vygotskian and Deweyan traditions suggest, we do not learn in isolation from others and studies of learning and cognitive development have long established that people naturally learn and work collaboratively throughout their lives. If cognition is embedded in situations, a significant aspect of those situations is that they are inhabited with mentors, experts and advanced peers who work, and think, alongside us. The idea that learners should work collaboratively is at once unsurprising and mildly radical. If we recall the model of traditional education rejected by Dewey and his fellow progressivists, collaborative learning was frowned upon because it did not require individual learners to acquire the rigor and independence of thinking that were highly valued in the rationalist as well as romantic world views. Certain ethical issues came into play as well, given a model of intellectual property that

conferred ownership rights upon a single inventor or author and that made group effort morally suspect (Ede & Lunsford, 1990).

But if, as Dewey suggests, school is a microcosm, collaboration induces a social order into the classroom that we find in the world around us. A learner's ability to advance conceptually results from cooperation with others, and thus education, accordingly, should make such cooperation explicit and transparent (Bruffee, 1986). Having students work together in collaborative problem solving has also been considered a powerful source of motivating learners. According to Brown and Palincsar (1989) the presence of other learners provides students with the means to gauge their own progress which, in turn, assists them in identifying their relative strengths and weaknesses and permits them the insight necessary to improve their own learning. Cooperative learning enables learners to share their knowledge and skills while providing opportunities for them to observe the learning process of others.

*Apprenticeship.* Closely related to collaboration is the notion of apprenticeship. Apprenticeship is an idea with which we have been comfortable for centuries, and in some form, it has served as the basis for most vocational education in the West. Even today it continues to be the means by which professions are perpetuated in much of the world. In the present context, however, apprenticeship has made the transition from a socio-economic arrangement to a theory of education as a result of its deep implication in theories of situated learning. The relationship of apprenticeship to constructivist theory lies in the acknowledgment that mental abilities and knowledge are deeply embedded in the social contexts in which they are used and that less experienced learners are guided through complex problem solving by more experienced peers or mentors. For this reason, apprenticeship is linked to the goal of authentic learning in that it is the natural learner-tutor arrangement. Unlike the consciously social and bureaucratic institution of formal schooling in which skills and knowledge are abstracted from their use, the relationship between mentors and those who learn from them is perceived as more spontaneous and multidimensional.

*Cognitive Flexibility.* The notion of *ill-structuredness* vs. *well-structuredness* signals an important distinction cognitivists have long made between types of *problem-spaces*—the mental arenas in which we conceptualize problems. Minsky (1961) explains that a well-structured problem is one in which we are given some systematic way to decide when a proposed solution is acceptable. Classic examples of well-structured (though complex) problems include chess playing and solving math problems. Using Minsky's definition we can see that both types of problems are well-structured for they culminate in an unequivocal result: arriving at checkmate or the mathematically correct answer. Conversely, as educators are well aware, most problems we confront on a daily basis are not well-structured. The idea of *getting it right* gives way to *making it acceptable in the circumstances.* Ill-structured problem solving is characterized by the problem's instability and the fact that different solutions may be appropriate depending on the constraints faced by the problem solver.

A much-cited response to ill-structuredness of everyday learning is *cognitive flexibility* (Spiro, Coulson, Feltovich & Anderson, 1988; Spiro & Jehng, 1990), a theory with deep roots in constructivist theories of reading and communication. Central to the notion of cognitive flexibility is the idea that no single perspective is adequate to the task of representing ill-structured problems and that a successful (i.e., cognitively flexible) learner is one who can readily cast and recast knowledge in response to varying situational demands. To attain this flexibility, learners must understand problems in their full complexity and must "criss-cross" the problem space in multiple passes in order to observe how shifts in variables and goals alter the space.

## Design Responses to Mediating Theories

Jonassen (1992) argues that "constructivism proposes that since learning is a process of actively constructing knowledge by integrating experiences into the learners' existing schemata, learning environments should support that process by providing multiple perspectives or interpretations of reality and enable knowledge construction in the learner through providing

context-rich, experience-based activities" (p. 349). Another way of saying much the same thing is to suggest that educational technologists are seeking ways to design pedagogical tools that respond to mediational theories such as collaborative learning, apprenticeship, and cognitive flexibility. While the following discussion isolates elements of learning environments that technologists believe contribute to the environment's authenticity, these elements rarely function independently; rather it is common for several elements to be combined into a single environment.

*Thick Problems.* The constructivist acknowledgment of cognition's situatedness reflects what we have always known: the problems we encounter in the world are rich in information. To allude to this richness in a more three-dimensional sense, we might go beyond the label of ill-structured and use Geertz's (1985) terminology to describe such problems as *thick.* In their efforts to make learning more authentic, a common response of educational technologists naturally has been to inject fuller complexity into problem solving by presenting learners with thick problems. Two examples of how the issue of problem thickness is accommodated by educational technologists are provided by the Cognition and Technology Group at Vanderbilt's (CTGV) notion of *anchored instruction* (CTGV, 1990) and the Schank group's *goal-based scenarios* (Schank, Fano, Bell, & Jona, 1994).

In the case of the CTGV's Jasper Woodbury materials, an anchored multimedia environment seeks to:

> present a situation as one would see it in the world, though it is orchestrated so that it has embedded in it all the data the students need to solve the problem. As in the real world, the presentation does not make clear which of the presented material is relevant to problem solving and which is incidental. Students must learn to differentiate between relevant and irrelevant data. . .The problems that are used are much more complex than typical math word problems on the premise that students cannot learn to deal with complexity unless they have had the chance to experience it. (Hmelo and Narayanan, 1995, p. 2)

The CTGV (1990) introduces the distinction between microcontexts and macrocontexts; the former focus on a specific subset of a more complex problem or domain while the latter seek to prompt exploration of the larger framework. The distinction is important for when they speak of anchoring instruction, they are referring to anchoring within a macrocontextual environment in which real-world complexity can be introduced. Macrocontexts permit the exploration of an authentic problem space for extended periods of time and from many different angles. The rich context provided by such information-dense instruction invites learners to find and define their own issues to explore.

Goal-based scenarios have also been put forward as an exemplary type of learning environment particularly well suited to the issue of thick problems. Goal-based scenarios are predicated on a number of assumptions, but one of the most important is the *authenticity principle* (Collins, 1994). According to this principle, "knowledge, skills, and attitudes should be embedded in tasks and settings that reflect the uses of these competencies in the world . . . the authenticity of the learning environment ensures that the knowledge gained will be readily available in the kinds of situations they will face in their [users'] work" (p. 30). An example of a goal-based scenario is the *Broadcast News* environment (Shank et al., 1994) that aims to teach high school students about a variety of social studies topics. In *Broadcast News* a large amount of actual newswire text and video footage is compiled on a single story in the recent past. The computer system provides students with informational assistance about the roles they are playing as well as background information on the stories on which they are working. The system also creates informational thickness by responding to learners' choices and making suggestions, thus providing a kind of environment that might be found in the world of broadcast journalism. While goal-based scenarios incorporate many of the other authenticating features listed below, the density of the informational resources available to the learner and thus the thickness of the problem is perhaps most noteworthy.

*Interactivity.* Whereas non-constructivist theories of education draw attention to the informa-

tion the teacher or curriculum wishes to impart to the student, the emphasis on individual construction has led many educational technologists to consider issues of learners' intentions and choices. A fundamental rationale linking interactivity to a constructivist account of learning is that interactivity shifts learning away from the directives of the instructor and toward the needs and wishes of the learner. Interactivity, in this view, permits learners to faithfully replicate learning in everyday situations by providing them with an opportunity to determine, to some degree, the form of instruction they receive.

Neuman (1995) has rightly noted that the computer's potential for interactivity has "become the focus of irrepressible optimism" among educational technologists (p. 52). In contrast to learning through passive exposure to information, interactivity is often especially valued for its ability to engage the student in the material because the activeness required of the learner is believed to provide a motivational boost to learning that traditional learning does not. Interactivity reflects the real world in many other ways as well. Perhaps most obviously, conversation is interactive. Just as conversation is a principal way we get information from others, so interactivity in a learning environment permits the user to mine the environment for the information sought. Having the learning environment respond to a student-generated answer or request mimics the sort of interaction common in the real-world of social communication. And just as in authentic social situations, the individual learner is given more control—in fact, required to take more control—over the pace at which information is presented.

*Hypertext and Hypermedia.* If we combine the ideas that authentic learning means (a) that learners should be introduced to informationally rich contexts for learning, and (b) that learners should be active participants in their own learning, we arrive at the principal rationale for hypertext and hypermedia in education. A major component in many technologized learning environments, hypertextualization provides a system of informational nodes linked to other nodes that can be easily accessed with a click of a cursor. Words, images and icons, even entire documents, can be made "hot" by an information designer (and increasingly by the learner) who provides the links necessary to jump to associated nodes, creating a web-like structure of information readily accessible to the learner.

The connection between hypertext and real-world learning is perhaps most clearly reflected in Jonassen's (1992) argument that "learners need instructional conditions that stress the interconnections between knowledge within cases as well as different perspectives of viewpoints on those cases that reflect the perceptions of different entities. Learners need flexible representations of the knowledge domains that they are studying, representations that reflect the uncertainties and inconsistencies of the real world" (p. 386). Here we see a common claim in the literature of hypertext: that the principles of association that shape hypertexts mirror the complexity of human information-seeking and problem solving (cf. McKendree, Reader, & Hammond, 1995).

*Collaborative and apprenticeship elements.* Whereas I have suggested above that there is a useful distinction to be made between theories of collaboration and theories of apprenticeship, in educational technology both ideas are often combined in environments that seek to replicate social relations that surround learning. Networked learning environments are one obvious response to this but there are others that more explicitly link collaboration and apprenticeship to the goal of authenticity. One such response is outlined in Collins' (1991) overview article on cognitive apprenticeship—the provision of prompts and modalities that replicate key aspects of the mentor-apprentice relationship. In Collins' view, technology creates numerous and cost-effective opportunities for apprenticeship learning that could not have existed earlier. Most obviously, perhaps, in an apprentice situation, an expert performance is modeled in ways that learners can appreciate and emulate. The computer can also serve the important role of coach by locating the point in the problem solving process where students are having difficulty and by providing as much coaching as the learner needs to accomplish the task. Such coaching functions range from providing the

learner with a set of problem-solving heuristics, as the situation warrants, to drawing upon a body of error patterns to guide a student through a task. Coaching provides the scaffolding necessary for a novice participant to approximate an expert performance though a series of successive approximations.

According to Collins, Brown and Holum (1991), technologies that support cognitive apprenticeship have the ability to actually improve upon the traditional (i.e., vocational) apprenticeship model. For instance, the CTGV believes that its anchored instruction can actually provide a more efficient variety of apprenticeship than real-world apprenticeships. The real-world model is inefficient in several respects, mostly because of the limitations of time and space that constrain apprentices working out in the world. For one thing, such apprenticeship leaves a lot to chance—because learning only occurs in response to the real needs that arise in the real workplace, apprentices in the real world can only play the hand dealt them. Educational technologies circumvent some of these limitations by creating learning contexts that are apprenticeshiplike in several respects but which permit a greater number of opportunities for self-correction and learning modification.

*Multimedia.* The link between multimedia and authenticity is intimate, for real life is fundamentally multimediated by the senses. Memory is thought to be encoded in ways dependent upon whether the information comes to us visually, tactually, aurally, affectively, and so forth. In everyday life, information comes to us in all these forms, each of which carries with it a particular dimension that cannot be replicated by the others. Visual information provides a spatial and physical-qualitative dimension of information that sound cannot; textual information permits a sort of explication that cannot be done pictorially; and aural input resonates with memories in a unique way (see Ong, 1982).

A typical example of constructivism-informed multimedia currently in use is the videodisc *A Right to Die?: The Case of Dax Cowart* developed at Carnegie Mellon's Center for Design of Educational Computing. Developer and ethicist Preston Covey (1990) provides a common rationale for both the Dax Videodisc and multimedia generally:

> computer-based multimedia can provide new channels to moral experience, added stimuli to moral imagination, as well as new opportunities for reflection on that experience. Multimedia environments are useful for the rich data, texture, and context they allow us to import into experientially barren groves of academic study—allied with interactive computer technology for easy control, flexible exploration, and the disciplined reflection it can induce. (p. 15)

Covey has elsewhere suggested that "teaching students what John Stuart Mill said doesn't drive home the reality of the situation, and you can't teach ethics without imparting that reality" (Mastracci, 1991, p. 28). For Covey and many others, multimedia provides the means to impart just such reality.

To summarize this section, then, as constructivists have come to identify authenticity as a precondition for learning, educational technologists have been busy both framing the issue of authenticity and designing environments that address it. In the next section, however, I wish to suggest that neither the goal of authenticating learning nor technologists' response to it are as transparent and unproblematic as they may seem.

## AUTHENTICITY AND PREAUTHENTICATION

A problem with the goal of authenticating learning arises when we remember that constructivism argues that the world is not understood independently of our experiences, and that, therefore, any sense of authenticity can be neither predetermined nor preordained. In Hacking's (1983) words, "We shall count as real what we can use to intervene in the world to affect something else, or what the world can use to affect us" (p. 149); that is, a thing is real insofar as it is prerequisite to (i.e., implicates) other things which we believe are real. Thus, much of what we know to be real is not known in any objective sense, but is believed (in the fully tentative sense of that word) to be real. The task of balancing a checkbook, for instance, may be an

authentic task from the perspective of a 21-year-old, but we would question its authenticity from the perspective of a 5-year-old. But more to the point, even among 21-year-olds, for whom we believe the task should be authentic, there are some who will find any given lesson in personal finance irrelevant, inaccurate, or otherwise inappropriate.

As we have already noted, educational technologists have responded to this epistemological dilemma by creating problems and environments that they have determined to be authentic; we might call this practice preauthentication. Preauthentication presumes that one can separate those tasks that are inherently authentic from those that are not. Few educational technologists have argued for preauthenticability as explicitly as the CTGV (1990) as it relates to their notion of anchored instruction. They first note that the construct of authenticity has more than a single dimension. At one level, anchored instruction is authentic because it uses actual facts and data. On a second level, it is authentic in that the tasks that individuals are asked to perform are those that they could legitimately be expected to perform if they found themselves in the actual situation.

Finally, they pose a question that, at first blush, appears to raise an epistemological flag: "for whom are these tasks authentic?" (p. 7). Further reading, however, reveals that they are not asking "who is construing these tasks as real?" but rather "who can make best use of the authenticity with which he or she is presented?" In other words, they ask the question in order to make the point that the software's user may not have sufficient knowledge, or expertise, to profit from its authenticity. This suggests that, for the CTGV's purposes, authenticity is objective—the programmer made the software authentic.

If the CTGV's assumptions clarify this usage of preauthentication, we might take this concept and use it to problematize the ways educators and technologists have attempted to apply constructivism to the classroom. For instance, the idea that making students work with others replicates the natural processes of social learning seems to reflect a shallow appreciation for what it means to be a learner embedded in a culture. Clancey (1993) advanced this sort of reductivism when he suggested replacing the individual as the psychological unit of study with the group. I would argue that one can retain the individual as the unit and recognize that the individual contains the social—operationalizing *social* to mean *group* does nothing to mirror the way in which cultures and ideologies functions.

Similarly, arguments for cognitive apprenticeship in educational technology (as it relates to authenticity) are problematic, for they reduce apprenticeship to a couple of key elements—elements that, not surprisingly, are emulatable with computer environments. Yet, as educational anthropologists have long noted, apprenticeship has less to do with the formal features of problem solving than the social environment in which learning occurs. Interpersonal relationships between learner and mentor with their attendant affective dimension are an absolutely indispensable part of any notion of apprenticeship (Cohen, 1971). In contrast, cognitive apprenticeship may assist in divorcing learning from the interpersonal contexts with which Vygotsky (1978), Luria (1976) and Dewey (1961) were so concerned. Electronic apprenticeship environments are to actual apprenticeship what computational models are to human cognition: important starting points for a conversation, but highly essentialized facsimiles of the original phenomena.

The argument that hypertextualization authenticates learning by having students set their own objectives is also overstated. Hypertext does not allow instantaneous connection of concepts in accordance with the user's own associations; the assumption that information connected in a hypertext parallels, in some significant sense, the way information is naturally connected in memory seems tenuous. For one thing, hypertexts are not neutral—they are constrained by a variety of factors: first and foremost, the information available for linking, which has been predetermined in most cases by others (McKendree et al., 1995). For this same reason, when considering anchored instruction or goal-based scenarios, we might ask "whose thickness is it, anyway?" As with hypertext and hypermedia, the information available to a learner in such environments is not that provided by the real world, it is generated by the

developers' idea of what informational denseness and conceptual association in the real world would look like.

In short, rather than prescribing authenticity, constructivism problematizes it. Constructivism gives us no reason to believe we can predetermine the correspondence of academic tasks to the real world, for that world is constantly being shaped and reshaped by learners working within their own experiences and constructed realities. Casting a wary eye on preauthentication does not challenge any of the mediating theories mentioned above nor does it illegitimatize any of the technological innovations that have been drawn from them. Anchoring instruction, creating cognitive apprenticeships, hypermediating information and other practices almost certainly can facilitate learning (which is, after all, what educational technology is supposed to do). However, the benefit to be derived from these technological innovations may have little or nothing to do with their ability to create authentic contexts for learning.

## IMPLICATIONS FOR DEVELOPMENT

If constructivism suggests that authenticity is a judgement rather than an objective state, the challenge confronting educators and educational technologists might usefully be framed as rhetorical; that is, how are learners *persuaded* that they are participating in authentic learning environments, and how can technology enhance this rhetorical goal? By accepting the impossibility of preauthentication, and thus the necessity of persuasion, we can, I believe, better accommodate the lessons of constructivism. In this section, I touch briefly on a number of rhetorically grounded observations that may assist in the development of persuasive educational technologies. While none of these observations prescribe new technological innovations, they do propose ways in which constructivist educators might use a rhetorical perspective to rethink issues such as learner models (including the variable of age), the educator's role in knowledge construction, distinctions among knowledge domains, and the learner's freedom to fail.

### Adjusting Our Learner Model

Instructional designers' under-elaborated acknowledgment of the ill-structuredness of everyday situations has erected and reinforced a model of the learner that moves with great efficiency through problem-spaces toward clearly identifiable solutions or at least a finite set of possible alternatives. Sack, Soloway, and Weingrad (1993) labeled this model *Cartesian*. In contrast to this, a rhetoricized conception of education asks us to consider that the student-as-audience is less a passive sounding board for the educator's lecture than an active interlocutor who is fully capable of evaluating claims, assessing evidence, and posing rebuttals.

Of course, one could easily argue that a rhetorical framework is not needed to make this point; constructivism has always been explicit in emphasizing the activeness of the learner. For instance, Bereiter and Scardamalia's (1989) rationale for promoting their notion of intentional learning is that "to the extent that students take an active role in learning, their own theories of what knowledge consists of and how it is acquired can be expected to matter" (p. 367). Such claims notwithstanding, however, the practices of preauthentication tacitly convey a model of the learner that is just as uncomplicated, inexperienced and complacent as the Cartesian learner model we claim to have rejected. The model of a learner who is cleansed of inappropriate attitudes and motivations continues to lie at the heart of constructivist education. Such a learner is not merely predisposed to efficiency and logic, but is affectively compliant with the educator's desires. This reflects many constructivists' somewhat sentimental presumption that students are fairly bursting with enthusiasm to learn if only educators would let them. And so while constructivists' try to account for variance in domain knowledge, skills and even personality types (cf. Shute 1993), they rarely address the learner who may have motivations other than those presumed by the educator.

Constructing a more appropriate learner model requires considering some other variables that preauthentication leads constructivist technologists to overlook. Key among these is an

interest in how (or whether) age plays any role in authenticating learning. On those rare occasions when the issue of age is dealt with directly, it is usually to caution the educator that the complexity of preauthenticated pedagogy needs to be adjusted according to the learner's level of expertise (cf. CTGV, 1990; Bednar, Cunningham, Duffy, & Perry, 1992). But applying a rhetorical lens to constructivist education suggests that perhaps authenticity, like youth, is wasted on the young. In the design of learning environments for young children, the issue of authenticity may be less pressing. Environments cannot appeal to a cogent sense of the real world for young children because they have a more malleable sense of, and less of a stake in, what the real world might be. In other words, authenticity's motivational charms have less appeal to people with no immediate intention of getting on in the world. As sociohistoricists such as Leontiev (1981) and Luria (1976) have noted, play is vital to early cognitive development and in such play situations the issue of authenticity per se does not even arise. Thus, though even the youngest learner constructs meaning, children's constructive processes are relatively more amenable to correction and less susceptible to arguments for a task's authenticity.

Approaching this issue from another direction, Perkins (1992) has argued that "buying into" a technological environment is critical to its success:

> Whatever the challenges of cognitive complexity and task management, a rather different kind of challenge concerns learners' attitudes towards the enterprise. When learners are asked to thrash around for themselves to some extent, there are often characteristic reactions such as "Why don't you just tell me what you want me to know?" Such learners are not "buying in" to the constructivist agenda of the instruction, a problem that inevitably stands in the way of a fully engaged learning experience. An ardent constructivist might naturally respond "Well, buying into this sort of thing is part of what they're supposed to learn. They'll come around.
>
> However heartfelt, I am not sure that such a response is entirely reasonable. From the learners' perspective, they are being asked to jump through hoops to discover × for themselves when they could, they think, straightforwardly be told × with some practice to follow to get used to doing things with ×. . . This is a lot to ask. (pp. 163–164)

A lot, indeed. Certainly, very young learners may be willing to suspend disbelief in their faith that teacher knows best, but it would be unreasonable to expect such good-naturedness from older students. One suspects that most 15-year-olds have a keenly developed sense of the bogus—the adult party line against which they define their own reality. Most things that matter come under re-negotiation by adolescents who are beginning to appreciate the interestedness of knowledge claims and beginning to understand that different lessons on the same topic can teach very different, even contradictory, things. This may especially be true of young people in the late 20th century who are raised on a postmodern diet of savvy and cynicism, and cannot be ignored when we design environments in hopes of leveraging authenticity.

## The Role of the Teacher

Another troublesome feature preauthentication perpetuates in constructivist educational technology is the fact that those doing the preauthenticating excuse themselves from the scene, hovering over the learner and learning environment, somehow apart from the cognitive dynamics transpiring below. And in a certain sense, constructivism's rhetoric of student-centeredness reinforces this absence by rationalizing the educator's removal from the scene, even while the educator remains in charge. The rhetorical perspective reminds us that we cannot ignore the constructive processes of the teacher. For many of the same reasons that naturalistic research methods have relied on participant observation, a rhetorical perspective on education asks educators and technologists to accept the importance of their own assumptions and meaning-making practices, for as task setters, informational resources and arbiters of performance, teachers have an enormous impact upon student learning.

Nowhere is the teacher's cognition more critical, perhaps, than in the role of legitimator of expertise. Constructivists who preauthenticate learning share with information-processing cognitivists a faith in a static notion of expertise, for the expert provides a touchstone against which educational success can be determined. A rhetorical approach, however, asks us to con-

sider that experts (especially in ill-structured domains) are only contingently bestowed with that title. Because expertise is socially accorded, new trends, tastes, politics and arguments can quickly dethrone experts and replace them with individuals whose performance was previously considered highly inexpert. Although one may be an objectively expert chess player or mathematical problem solver, who is an indisputably expert teacher, manager, psychologist, economist, or writer? For the technologist interested in encouraging expertise in students, the rhetorical view on authenticity recommends not only that we attend our students' ability to demonstrate their understanding of information in traditional ways (e.g., in formal examination), but also that we support their ability to articulate this understanding and share it with others effectively and convincingly.

## Variation among knowledge domains

This raises the related and important issue of variation among knowledge domains. With few exceptions, discussions of authenticity in educational technology avoid the issue of knowledge domain. With even fewer exceptions, the archetypal examples of authentic learning are well-structured problems to which correct answers are possible and empirically verifiable. A rhetorical response to this might be twofold: First, and most obviously, there is a sizable chunk of most domains that limits certain dimensions of constructivism's applicability. In other words, greater attention needs to be paid to the question of what sorts of tasks in what kinds of domains are open to arguments for authenticity. The second response is a reminder that educators may have reasons for wishing to embed their lessons in artificial contexts, and that authenticity, in some cases, may conflict with other pedagogical objectives.

Looking more closely at the first point, a rhetorical framework suggests that we should avoid clinging too tenaciously to the goal of authenticity without regard for whether the problem at hand lends itself to authentication; as Anderson, Reder, and Simon (1996) put it, "how tightly learning will be bound to context depends on the kind of knowledge being acquired" (p. 6). For instance, a constructivist math professor may insist that teaching the notion of compounding is best facilitated by embedding it in a word problem using a real-world context such as paying a mortgage. In this case, however, the appeal to authenticity is not only mundane but perhaps unnecessary; providing any sort of context for the task may be more important than providing an authentic context. Given the variation among domains, then, the technologist should consider the nature of the knowledge to be taught when proposing to inject authenticity into the classroom.

Examining the second point, it is also worth considering whether authenticity accommodates every sort of pedagogical objective. Although authenticity has become something of a mantra in educational technology, there is much that students can learn by engaging in environments and tasks without any pretense to genuineness. In fact, there are domains such as applied ethics and law where the idea of what it means to learn may require certain kinds of cultivated detachment (cf. Petraglia, 1991). One reason we may wish this detachment has to do with our interest in introducing students to disciplinary practices which, by their very nature, require a relatively narrow outlook on their objects of study. A thoroughgoing understanding of a disciplinary perspective may be short-circuited in the sort of rich contexts represented by anchored instruction whereby the thickness of the context is privileged over careful and systematic investigation. In other words, educators may argue that there are some problems that we wish to decontextualize for a reason; their occurrence in nature is neither part of their appeal nor part of our pedagogical objective. In fact, some problems' complexity may be precisely what we wish to strip away for purposes of uncovering first principles or presenting similarities among a set of problems.

## Freedom to Fail

A final observation may be of little immediate use to technologists, yet it may be the most important lesson constructivism teaches: students are free to fail. This runs counter to the preauthenticatory assumptions of education

and educational technology which are accustomed to telling stories of getting it right—of figuring out what is going wrong and then remediating the error rather than revising the basic structure of the enterprise and the motivations of learners. Ironically, education's aversion to failure may be one of the reasons why students' reality counts for so little in technologists' calculations. It might be considered rude or defeatist to acknowledge that students have lives outside school that are more important to them than the lives with which we are willing and able to work. Instead, many educators, constructivist or otherwise, are eager to presume a greater degree of dedication on the part of students than my experiences as a teacher (and especially as a former student) suggest is warranted.

What Aristotle identified as rhetoric's natural concern with probability rather than certainty suggests that the genuinely constructivist education must be aware of the limits of persuasion and thus arguments for authenticity. In Book One of *Rhetoric*, for instance, he reminds us that we argue with no assurances that our arguments will succeed and advises that we come "as near such success as the circumstances of each particular case allows" (p. 6). Again, for the technologist, recognition of this may have few direct implications for designing environments, but it should inform their general approach to constructivist education. Far from denigrating students, acknowledgment of their freedom to fail validates them as complex individuals with aspirations that may have very little to do with the desire to learn whatever is put before them. Taking constructivism seriously means facing the discomfort of not knowing ahead of time what students will accept as an everyday or real-world problem and instead viewing authentication as an on-going process that will present the teacher with many rhetorical opportunities but no guarantees.

## CONCLUSION

In a short essay that asserts many of the claims I have presented in this article, Jonassen (1994) notes that the critical difference between the dominant technological paradigm of the '60s and '70s and the present constructivist paradigm lies in our assumptions regarding the predeterminability of learning processes and outcomes. In contrast to instructional design, "constructivism believes that learning outcomes are not always predictable and that 'instruction' should foster, not control, the processing of the learner" (p. 35). He goes on to note that "constructivist instruction" is an oxymoron if by instruction we mean a process of getting knowledge into students' heads. The real challenge facing technologists, according to Jonassen, is to consider the goals of instruction in a particular context and then to adjust the strategies, models and tactics necessary to attune the nature of the task to the perspective of the student.

This is seconded by Driver, Asoko, Leach, Mortimer, and Scott (1994) who argue that

> If students are to adopt scientific ways of knowing, then intervention and negotiation with an authority, usually the teacher, is essential. Here, the critical feature is the nature of the dialogic process. The role of the authority figure has two important components. The first is to introduce new ideas or cultural tools where necessary and to provide the support and guidance for student to make sense of these for themselves. The other is to listen and diagnose the ways in which the instructional activities are being interpreted to inform further action . . . (p. 11)

Indeed, the challenge educators face has less to do with giving the right information, or offering students an empty shell within which they can discover their own knowledge, than with engaging the learner in a dialogic process that gives the learner an opportunity to articulate his or her understanding and offers the educator the best hope of intervening in it. The rhetorical observations I have made here converge on the importance of supporting both the dialogic dimensions of learning and the ambiguity that infuses knowledge.

To conclude, I concur with those educational psychologists and technologists who argue that technology augments the educator's ability to enrich learning environments in ways scarcely imaginable only a decade ago. As electronic environments are expanded and refined, the capability of educational technology to persuade learners of the authenticity of the tasks they are asked to perform must also surely grow. It is

important, however, that constructivist technologists do not lose sight of the critically dialogic dimension of knowledge-making and the ultimate power of learners to determine the authenticity of the problems and task environments that are set before them. □

---

Joseph Petraglia teaches rhetoric and sociocognitive perspectives on education at the Georgia Institute of Technology. Many of the issues raised in this article are developed in his recent (1998) book entitled *Reality by Design: The Rhetoric and Technology of Authenticity in Education.*

## REFERENCES

Anderson, J.R., Reder, L.M., & Simon, H.A. (1996). Situated learning and education. *Educational Researcher, 25*(4), 5–11.

Aristotle. (1932). *Rhetoric.* (L. Cooper, Trans.). New York: Appleton-Century.

Bednar, A.K., Cunningham, D., Duffy, T., & Perry, J.D. (1992). Theory into practice: How do we link? In T. Duffy & D. Jonassen (Eds.), *Constructivism and the technology of instruction* (pp. 17–43). Hillsdale, NJ: Lawrence Erlbaum Associates.

Bereiter, C., & Scardamalia, M. (1989). Intentional learning as a goal of instruction. In L. Resnick (Ed.), *Knowing, learning, and instruction* (pp. 361–392). Hillsdale, NJ: Lawrence Erlbaum and Associates.

Brown, A.L., & Palincsar, A.S. (1989). Guided cooperative learning and individual knowledge acquisition. In L. Resnick (Ed.), *Knowing, learning, and instruction* (pp. 393–452). Hillsdale, NJ: Lawrence Erlbaum and Associates.

Bruffee, K. (1986). Social construction, language and the authority of knowledge. *College English, 48,* 773–787.

Clancey, W. (1993). Guidon-manage revisited: A socio-technical systems approach. *Journal of Artificial Intelligence in Education, 4*(1), 5–34.

Clark, J.M. (1995). *Cognitive apprenticeship, motivation, and college writing: Theoretical and pedagogical considerations.* Unpublished doctoral dissertation. Bowling Green State University, Ohio.

Cognition and Technology Group at Vanderbilt (CTGV). (1990). Anchored instruction and its relationship to situated cognition. *Educational Researcher, 19,* 2–10.

Cohen, Y.A. (1971). The shaping of mens's minds: Adaptation to imperatives in culture. In M. Wax, S. Diamond, & F. Gearing (Eds.), *Anthropological perspectives on education.* New York: Basic.

Collins, A. (1991). Cognitive apprenticeship and instructional technology. In L. Idol & B.F. Jones (Eds.), *Educational values and cognitive instruction* (pp. 121–138). Hillsdale, NJ: Lawrence Erlbaum and Associates.

Collins, A. (1994, November-December). Goal-based scenarios and the problem of situated learning: A commentary on Andersen Consulting's design of goal-based scenarios. *Educational Technology,* 30–32.

Collins, A., Brown, J.S., & Holum, A. (1991). Cognitive apprenticeship: Making thinking visible. *American Educator,* (Winter), 6–11, 38–46.

Covey, P.K. (1990). Integrating emotion in moral reasoning and learning. In R. Kozma & J. Johnston (Eds.), *Educational computing in the humanities.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Dewey, J. (1938). *Experience and education.* New York: Collier.

Dewey, J. (1961). *Democracy and education.* New York: Macmillan.

Driver, R., Asoko, H., Leach, J., Mortimer, E., & Scott, P. (1994). Constructing scientific knowledge in the classroom. *Educational Researcher,* 23(7) 5–12.

Dunn, T.G. (1994). If we can't contextualize it, should we teach it? *Educational Technology Research and Development, 42*(3), 83–92.

Ede, L., & Lunsford, A. (1990). *Singular texts/plural authors: Perspectives on collaborative writing.* Carbondale, IL: Southen Illinois University Press.

Geertz, C. (1985). *Local knowledge: Further essays on interpretive anthropology.* New York: Basic Books.

Greeno, J.G. (1989). A perspective on thinking. *American Psychologist, 44*(2), 134–141.

Hacking, I. (1983). *Representing and intervening.* Cambridge, England: Cambridge University Press.

Hmelo, C.E., & Nararyanan, N.H. (1995). Anchors, cases, problems, and scenarios as contexts for learning. *Proceedings of the 17th Annual Conference of the Cognitive Science Society.* (5–8). Hillsdale, NJ: Lawrence Erlbaum Associates.

Jonassen, D.H. (1992) Cognitive flexibility theory and its implications for designing CBI. In S. Dijkstra, H.P.M. Krammer & J.J.G. van Merrienboer (Eds.), *Instructional models in computer-based learning environments,* (pp. 385–403). Berlin:Springer-Verlag.

Jonassen, D.H. (1994, April). Thinking technology: Towards a constructivist design model. *Educational Technology,* 34–37.

Leontiev, A.N. (1981). The problem of activity in psychology. In J. Wertsch (Ed.), *The concept of activity in Soviet psychology.* Armonk, NY: Sharpe.

Luria, A.R. (1976). *Cognitive development: Its cultural and social foundations.* Cambridge, MA: Harvard University Press.

Mastracci, M. (1991). Confronting real-world ethics on videodisc. *Carnegie Mellon Magazine, 9*(3), 26–29.

McKendree, J., Reader, W., & Hammond, N. (1995). The 'homeopathic' fallacy in learning from hypertext. *Interactions. 2*(3), 74–82.

Minsky, M. (1961). Steps toward artificial intelligence. *Proceedings of the IRE, 49,* 8–29.

Neuman, W.R. (1995, January). The psychology of the new media. *Educom Review,* 48–54.

Ong, W. 1982. *Orality and literacy*. London: Methuen.

Perkins, D.N. (1992). What constructivism demand of the learner. In T. Duffy & D. Jonassen (Eds.), *Constructivism and the technology of instruction* (pp. 161–165). Hillsdale, NJ: Lawrence Erlbaum Associates.

Petraglia, J. (1991). *Exploring the effects of realism on arousal and rhetorical representation.* Unpublished doctoral dissertation, Carnegie Mellon University, Pittsburgh, PA.

Petraglia, J. (1998). *Reality by design: The rhetoric and technology of authenticity in education.* Mahwah, NJ: Lawrence Erlbaum Associates.

Piaget, J. (1970). *Genetic epistemology.* (E. Duckworth, Trans.) New York: Columbia University Press.

Resnick, L.B. (1990). Learning in school and out. *Educational Researcher*, 13–20.

Sack, W., Soloway, E., & Weingrad, P. (1992). Re-writing cartesian student models. *Journal of Artificial Intelligence in Education*, 3(4), 381–402.

Schank, R., Fano, A., Bell, B., & Jona, M. (1994). *The design of goal-based scenarios.* Unpublished manuscript. Institute for Learning Sciences, Northwestern University.

Shute, V. (1993). A macroadaptive approach to tutoring. *Journal of Artificial Intelligence in Education.* 4(1), 61–93.

Spiro, R.J., Coulson, R.L., Feltovich, P.J., & Anderson, D.K. (1988). Cognitive flexibility theory: Advanced knowledge acquisition in ill-structured domains. In *Proceedings of the Tenth Annual Conference of the Cognitive Science Society.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Spiro, R., & Jehng, J-C. (1990). Cognitive flexibility and hypertext: Theory and technology for the nonlinear and multidimensional traversal of complex subject matter. In D. Nix & R. Spiro (Eds.), *Cognition, education, and multimedia* (pp. 163–202). Hillsdale NJ: Lawrence Erlbaum Associates.

Vygotsky, L.S. (1962). *Thought and language.* Cambridge, MA: MIT Press.

Vygotsky, L.S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.