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ABSTRACT

Technology adoption concerns are increasingly important to understanding constructivist learning environments and learning communities. As instruction begins to move toward more open, participatory models, "end users"--both teachers and learners--are asked to take more responsibility in the learning process. Issues such as the variable implementation of instructional design (ID) products, the functioning of open models of instruction, and the pros and cons of the Internet have direct impact on the lives of instructional designers. This paper relates adoption to design and covers: use concerns within the design process; role versus activities of design and use; learning resources; the blurring of the distinction between design and use in hypertext environments like the Internet; and the continued blurring of distinctions between designers and end users versus teachers and students. Implications for instructional design practice include: (1) ID is much more than materials- or message design, incorporating issues of utilization, market, and adoption; (2) consideration of context of use is more than adding steps to a design model; (3) end users always function as designers as they appropriate and use learning resources, even if they are not involved in the formal design of the resources; (4) teachers must appropriate and adapt instructional materials to their specific needs; (5) the same negotiated dynamics between designers and teachers exist between teachers and students; (6) designers must look for total effects of interventions on all participants; (7) end users need to think like designers as well as consumers; and (8) new frameworks for understanding adoption and change are needed. (Author/SWC)

Understanding the Design and Use of Learning Technologies

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For the past few years, I have grown increasingly interested in technology adoption. Why do people choose to make use of an instructional product or learning resource—and why do they sometimes resist? My interest in this question has been stimulated by witnessing an accumulating number of failed instructional design (ID) projects—failed in the sense that products were weakly or only partially implemented in the way intended by their designers. Of course, the failure of ID projects is nothing new; war stories of such failures are part of every experienced designer's repertory of cautionary tales. Yet remarkably little discussion of lessons learned from failures is made in the literature. We seem to be much more willing to discuss our successes than our flops!

Adoption concerns are increasingly important to understanding constructivist learning environments and learning communities. As instruction begins to move toward more open, participatory models, "end users"—both teachers and learners—are asked to take more responsibility in the learning process. Seen as adopters of technologies and products, participants need to be sold on the approach and supported in their new learning.

Another accounting for my renewed interest in adoption lies in the different responses to the Internet and the World-Wide Web. As an observer, I have witnessed widely varying reactions to this overwhelming new technology, ranging from populist enthusiasm to mistrustful resistance. People differ widely on questions of free speech, copyright, Web publishing, and the learning potential of the Web. Some people are ecstatic that educational institutions have lost their near-monopoly on learning resources; others fear that inaccurate, unreliable information, coupled with uncontrolled communication, will lead to a number of social and educational problems. Some people depend on e-mail not just for professional communication, but as a vehicle for intimate sharing of deeply human experiences. Others have decided that e-mail intrudes too heavily into their lives; that in sum, the impact on quality of life is too great to be worth the benefits.

These issues—the variable implementation of ID products, the functioning of open models of instruction, and the pros and cons of the Internet—have a direct impact on my life, since I am a designer of learning environments and an active participant of Internet resources. As a result, I have been relating these newer adoption issues to traditional concepts of instructional design I was trained on. How does design relate to use? Are the two spheres competing or complementary? Do they overlap or are they separate concerns?

The purpose of this paper is to explore some of these issues. To understand how adoption relates to design, I discuss both concepts together, with implications for both design and adoption practices. My hope is that we move toward a reform of professioinal practice, with stronger links to contexts of use, and correspondingly greater attention to adoption and effective use of learning resources.

Use Concerns within the Design Process

Instructional design involves the preparation, design, and production of learning materials. The ID process results in several key instructional components, including:

—learning goals and objectives;
—methods and instrument for assessing learning progress;
—content or information needed to accomplish the learning objectives;
—messages to be presented;
—student activities and learning interactions.

Some of these can be more completely prespecified than others, and the degree of prespecification will vary. For example, computer-based tutorials will need to be more pre-packaged than classroom resources for an experienced teacher.

Questions of use and adoption impinge directly into the design process. The products of ID—instructional resources—are meant to be used, either by a particular individual or group or a more general audience. Products are

worthless if they are not used. With this in mind, the ID process includes a number of strategies or steps to accommodate the likely needs of users, most notably

—context or environment analysis (Tessmer & Harris, 1992);

—formative evaluation to provide data from field tryouts and user feedback.

Efforts receiving somewhat less emphasis but equally important are participatory design, that is, the inclusion of user/practitioners throughout the design process; and consensus-building among users and constituencies.

These strategies are "use-oriented"; they increase the likelihood of successful implementation because they take the end use into account at beginning design stages. For that very reason, however, such strategies are often neglected at the expensive of more immediate, pressing needs of design and production. Involving end users in the design process is often seen as an unjustified expense. Formative evaluation and related strategies seem to be honored more often in breach than practice (Wedman & Tessmer, 1993).

So why are so many carefully designed products sitting on shelves? Perhaps designers don't incorporate enough of these use-oriented strategies. Or perhaps the overall quality of the design is flawed. I have heard design proponents argue that if you do your analysis right up front, your product will fill a legitimate need; ergo, it will be used. Somehow, though, I am not convinced that careful design alone can ensure successful implementation and use. We need renewed attention to utilization concerns throughout the design process, through strategies grounded in new theory. We also need to better understand the adoption process as a separate sphere of concern.

Roles versus Activities of Design and Use

I find it useful to distinguish primary roles from functions or activities. My primary role may be that of an instructional designer, yet I may engage in various activities where I try out or use the product or service in question, and participate in the community of practitioners and users. Similarly, an end user may participate in the formal design process, or may engage in design-type activities on the job—after the product's design is allegedly complete. Table 1 depicts this crossing-over effect.

This distinction acknowledges the mixed nature of the work of both designers and end users. To be effective, designers must participate in the practitioner culture to at least some degree regardless of their level of content knowledge. Similarly, to make best use of learning resources, end users must think in design terms, appropriating those resources and making them fit local conditions.

Learning Resources: Artifacts or Offerings?

The products of instructional design can be thought of in a number of ways. At one level, they serve as knowledge containers, carrying the expertise of designers and their backers, intended to convey that expertise to students. In this role, learning resources become artifacts which support individuals and groups in their knowledge-based activities. Knowledge is stored, in other words, in people's heads, in a culture's shared beliefs and values, and in that culture's repository of artifacts—documents, products, institutions, and so forth. Instructional materials constitute an important kind of artifact in our culture.

Seen as knowledge containers, learning resources embody expertise, yet they cannot stand alone. Of themselves, they have no knowledge value. Only in their appropriation and use by people can their knowledge value be realized.

At another level, learning resources can be seen as tools in the hands of an end user, enabling a teacher to effectively communicate, present information and direct fruitful interactions. Students, too, can appropriate learning resources in tool-like fashion, to further their learning according to their interests and goals.

The tool metaphor stresses the enabling or facilitative function of learning resources. A product is thought to be useful as it is manipulated to solve someone's problem. Using the tool, teachers and students are able to communicate, teach, and learn more effectively.

ROLE	Design	Use
Designers	Traditional ID activities—planning, analyzing, designing, etc.	Field experience Practitioner experience Practitioner dialogue Community participation
End users	Adapting instruction to locating setting Integrating technology into curriculum Selecting parts of product to appropriate	Traditional utilization and adoption activities—teaching the lesson, completing the assignment, etc.

ACTIVITY

Table 1. Overlap between roles and activities among instructional designers and users of their products.

A more personal way to see learning resources comes from asking, who is communicating what to whom? Learning resources are presented to students within a social context, and that web of social relationships helps to define how students interpret resources. Suppose a 7th grade girl is given a self-paced book meant to teach grammar. How might this student respond to the proffered learning resource? A number of possibilities are open to her, including:

—accept or reject the book;
—think about what's being read or plow through to complete the task;
—actively question or passively receive the content;
—relate the book to prior knowledge or tack on top of prior knowledge;
—upon perceiving the book's weaknesses, quit; or overlook the weaknesses, compensate, and continue on.

Part of the student's response to the book will depend on who gave her the book. Does she trust the teacher to seek her best interests? Does she think the teacher likes her as a person? Does she associate the book and the book-giver with positive experiences in her life? The point of view presented in the book itself might also affect her response. Do she and the author connect? Does the author consider her prior knowledge and communicate new ideas clearly and effectively? Asking about the learning resource in these ways treats it as something offered to the student by another person. The person-to-person relationships have a bearing on the acceptance of the resource.

When instruction is seen as an extension or offering of another person, the student enters into a kind of relationship with that person through the instruction. The designer of the materials might be heard saying, "Whoever you are out there, I am trying to reach you and meet your needs." The student might respond to the resource—or the gift-giver associated with the resource—"You are asking me to read, or think, or answer a question. Do I trust you to teach me something worthwhile if I cooperate?" Or, "You want me to learn from this book, but it's so boring! You're not listening to my needs!"

On the other hand, the student might not think in such terms at all. In a recent conversation with my son over a poor grade in English, I suggested that his teacher might be disappointed in his performance. "What? What are you talking about?" He had never contemplated the possibility that when students refuse to hard work and learn, a teacher might feel bad. Teachers are people too, I reassured him!

Whether or not students personify the intentions of the teacher or implicit author, they nonetheless can be said to engage in a kind of dialogue with the instruction. There is a mutual responding back and forth between teachers and students, or between learning resources and users of those resources. The conversation is an exchange of

ideas and thoughts, based on a relationship with a particular history of trust, varied motives, mistakes, and forgiveness.

Reading, Writing, and the Web

At this point, I feel rather out on a limb. This kind of language—trust, relationship, forgiveness—just isn't found in the ID or technology literature. What value is there in speaking this way? As we mentioned at the outset, as learning resources find their way into open learning environments and communities, students are expected not just to perform, but to make wise decisions. For an open learning system to prosper, participants must choose to use learning resources to support their own learning and for the growth of the whole group. Students in such environments can still look to teachers and informal leaders for direction, but responsibility is much more diffused than with traditional teacher-led instruction. Under such conditions, questions of motivation become at least as important as questions of technical skill-building or knowledge accumulation. And motivation, I am increasingly convinced, can only be understood by including cultural and social factors, to supplement traditional psychological and information-processing factors.

The distinction between design and use becomes most blurred in open hypertext environments like the Internet. George Landow (1992) has explored how hypertext turns readers into authors by giving them control over the story line, the flow, the content, and ultimately the meaning of the text. Similarly, hypertext authors surrender control and participate more flexibly in the conversation, reducing the traditional gap between reader and author, in the discussion.

What is true for literary criticism is true for education as well. I send my students to the lab to browse the Web and complete a research assignment. Who is the instructor here? Who determines content, sequence, and learning objectives? More than before, I share the design function with my students. And that is just the beginning. When my students go home or stay after school, browsing the Web and initiating their own learning activities, they have appropriated much more of the design function away from formal institutions. That such activity is going on—among both adults and children—is evident from the tremendous growth of listservs and online discussion groups of all kinds. The informal learning happening is nothing new; what is new is the technology that allows powerful representations and communications to take place, and the resulting burst of human knowledge now being found on the Web.

Continued Blurring of Distinctions

We have seen a parallel between:
—designers and end users; versus
—teachers and students.

With both pairs, the role should not be confused with activities or functions being performed. Designers can be users, just as teachers can be learners. Also, both relationships are amenable to a wide range of negotiated roles. We can build systems where the line between designers and users is entirely blurred, with mixing of roles and crossing over of assignments. This is presently the case on the Internet, and more particularly, in MUDs and MOOs, where users can become designers almost from the start, and where the environment's design benefits and suffers accordingly. Open models like this contrast strikingly with traditional institutions of learning. The same contrast is seen among teachers and students—Some models throw everyone into an environment, with barely discernible differences in roles. In general, we might say that models with highly contrasting roles are more top-down, hierarchical, and formal, whereas models with merging of roles are more open, decentralized, and informal.

Which is better? Should we maintain role distinctions between the expert authority and the end user, or should we encourage the merging of responsibilities? Under what conditions would we expect clear role divisions to be helpful or hurtful? These questions can be addressed from different perspectives—scientific, political, moral. A static, scientific approach would tend to look for general rules that govern such systems. A more contextualized approach would be to look at the history of interactions and the relationships between actual participants. What has been negotiated in the past? What kind of local culture has evolved? What are people's expectations?

Consider a classroom example. A 10th grade boy asks to have a biology assignment waived, because he already understands the concepts of the coming unit, and he wants to work independently in a related but separate direction. In essence, the student is asking to assume more of the teaching role himself, to create his own agenda and take charge of his own learning. The teacher responds to this request based upon the relationship between the two of them. The student has completed assignments punctually and has performed well on exams and labs. He is old enough to have developed mature study habits. On the other hand, customizing a plan of study will require more

supervision and vigilance on the teacher's part. Making an exception could also set a bad precedent for other students less ready to handle the responsibility. When it comes down to it, the decision is negotiated between the two of them, based upon these factors and a variety of others. In large part, the decision rests upon the teacher's willingness to accommodate individual needs, and reapportion additional energy and attention toward the individual student. The outcome depends heavily on contextual issues, local and unique to the situation and not easily subsumed by general rules and principles.

In summary, role distinctions generally serve a valuable purpose. Access to expertise in the form of a teacher or well-designed instructional materials can spare learners headaches and wasted time. In an open market, people spend enormous sums on formal training and instructional products, because they have a hard time learning by themselves. At the same time, emerging network and representation technologies threaten to displace the designer/teacher's near-monopoly on learning support. We are led, then, to an irony: Designers and teachers are most effective when they participate along with their clients in the practitioner culture and reach out to contexts of use; similarly, end users and students perform best when they assume more responsibility for their own actions and engage in designing/self-teaching activities themselves.

Implications for Practice

A co-dependent view of designing and using technologies leads to a number of implications for practice. For instructional designers, several conclusions can be drawn:

ID is much more than materials- or message design. Seen in the context of practice, ID incorporates issues of utilization, market, and adoption. The more practitioners enter into the design process, the greater likelihood that the outcomes will meet the needs of the field. Generally, these concerns tend to be neglected, both in practice and in ID literature.

Consideration of context of use is more than adding steps to a design model. ID will best be served by a more fundamental shift in perspective, granting equal status and concern to issues of adoption and use. The most recent edition of Dick and Carey (1996) contains a new section on context analysis, filling twenty-six of more than three hundred pages. This is good, but it's only a start. Designers who have any hope to seeing their work used effectively need to respond more closely to the needs of their clients. This cannot be ensured by a front-end questionnaire or reliance on a subject-matter expert pulled away from her job. There needs to be more of a meeting between design lab and job setting, where participants interact and participate in a common culture.

Participatory design is a somewhat redundant term. End users always function as designers as they appropriate and use learning resources, even if they are left entirely out of the formal design of those learning resources. Like it or not, users continue the design process as they determine how and where to make place for resources in their lives.

"Teacher-proofing" materials is impossible. The kind of attitude that says, "use these materials as we have designed, and don't deviate from our plans" only serves to weaken the value of those materials. Rigid, inflexible products that block users from experimenting or adapting can be frustrating and off-putting to users. Such products are crying out to be ignored. Our point is that teachers *must* appropriate and adapt materials to their local conditions; in doing so, as we have emphasized, they are co-designers of the learning experience, along with their students.

The same negotiated dynamics between designers and teachers exist between teachers and students. Teachers and students depend upon each other to cover for one another—students filling in what the teacher missed, and the teacher learning along with the students. In this way, they mirror the relationship between designer and user. No designer can know from the beginning just now a product will be put to use. A healthy respect for varied contexts of use will result in learning resources that are more flexible, modular, and accessible.

Designers must look for total effects of interventions on all participants. Many innovations fail because they neglect the changed roles demanded of the people expected to use the technology. User participation in design is a step toward accommodation of their perspectives. Designers are well-advised to carefully analyze the expectations placed on participants, and design ways of supporting those participants in their new roles and activities.

There are additional implications extending to adoption and use activities, including the following:

End users need to think like designers as well as consumers. Teachers need to be taught to actively appropriate resources and technologies, rather than passively follow the program. Curriculum design and integration may begin at national or district levels, but the most important work is done at the local level. Teachers need permission and validation to complete the task.

We need new frameworks for understanding adoption and change. Present discussions of adoption are heavily influenced by the Everett Rogers (1995) model of diffusion of innovations. This model is descriptive of objective categories and types, but tends to neglect underlying systemic processes. The present paper has emphasized adoption perspectives "from the inside"; that is, from participants' points of view. Systems models can complement that inside view by providing a useful outside view (*cf.* Wilber, 1996), showing how individuals and groups accommodate new technologies and innovations, following predictable patterns of resistance, accommodation, and integration.

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