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ABSTRACT

The relative cognitive requirements and benefits of learning from non-contrived experience and information presentation is considered. The advantages and costs are contrasted with contrived experience and information-reduction that are features of instruction. An overview is given of one method of viewing the relationship between experience and information, in the form of an experience to information continuum. Experience is discussed in terms of computer and instructional technology; virtual reality; the cognitive operation of forming concepts; language; constructivism; and possible instructional tools and approaches. Information availability, access to information, and information-based learning systems are examined. The richer meaning of instruction in the context of instructional technology is explored. It is asserted that instruction should be a process that involves both sources of learning (experience and information), as the situation requires. Caution is advised against the seduction of adopting computer-based learning environments. The nature of learners' prior knowledge, motivations, beliefs, and the nature of the potential learning outcomes are all crucial in making instructional decisions. (Contains seven references.) (MAS)

Title:

An Essay on Experience, Information, and Instruction

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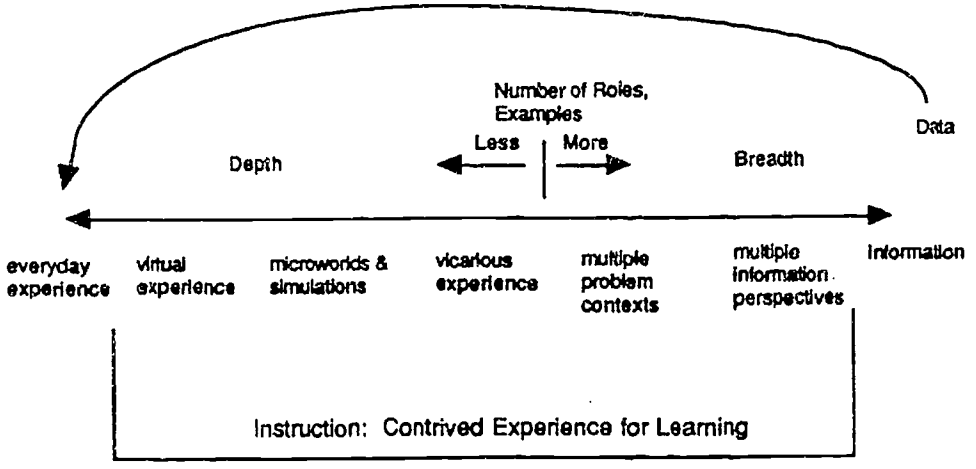
About ten years ago Nolan Bushnell, the founder of Atari and microelectronics pioneer, was the keynote speaker for AECT. One striking picture that Bushnell portrayed of educational technology in the future is the ability through virtual reality to come close to first hand experience of any event or place. Instead of reading about Italy, a student will be able to walk down the streets of Italy where (s)he wishes to go, smelling the smells, feeling the sunshine. Instead of reading, hearing about, or passively watching a reenactment of the "Boston Tea Party" students could actually "participate" in it, hacking open barrels of tea and tossing them into the Boston Harbor. Being true fans of the "Star Trek Next Generation" *holodeck* we have been enchanted by the educational future that Bushel presented. At the same time, as educational technologists, instructional designers, learners, and tax-payers, we were immediately both struck by the effort involved in such virtual experiences and by the uncertainty of when such experiences would be so desirable that the costs would be worthwhile. We have also conjectured about if or when such experiences might actually be deleterious to learning. Although these issues do not "map" directly upon the issues of situated cognition, they are related to some of the recurring issues addressed by instructional designers and instructional theorists regarding the role and nature of experience in learning.

Recent developments in microelectronic technology have made substantial changes on how experience and information are perceived. These changes have also contributed to a major shift in how instruction is perceived. Instructional technologists must keep abreast of not only the product technology developments and their impact on popular culture but also, and perhaps most importantly, the implications and repercussions for instructional technology. It is easy to become swept up in the flow of the more widely-held popular interpretations of "technology," loosing both traditional strengths and intellectual leadership so desperately needed in times of change. In this paper we will consider the relative cognitive requirements and benefits of learning from non-contrived experience and information presentation, and contrast these advantages and costs with contrived experience and information-reduction that are features of instruction.

In our reflecting on these issues we have constructed one perspective of how experience and information relate to each other and to instruction. We later in this paper will discuss these terms but here we will overview one way of viewing these relationships that may be productive for instructional technologists. The dimension represented on the continuum is abstraction of experience. In "everyday experience" the only abstraction that occurs, is that which the individual performs on the raw stimulus data. On the other end, information is data that has been reduced and organized by the author in order to represent his or her personally relevant interpretation of multiple events, objects, and experiences.

Figure 1. Experience to information continuum.



Experience

Recent developments, and much-discussed pending ones, in computer technology are changing what a person can anticipate in the way of feasible experiences. Increasing precision and realism of available computer-driven simulations now provide "experience" in flying private aircraft, WW-I biplanes, WW-2 fighter aircraft, F-18 "Tomcat" and other current supersonic military aircraft, in either cross-country flight or in combat with other aircraft. These simulations are available to anyone with a personal computer and $29 for the purchase price of the software. At lower levels of fidelity, these and other real-time simulations were available 15 years ago for use on Apple II computers: This technology can no longer be considered new. "Artificial experience," whether represented by aircraft simulators, chess players, city-building, skiing, golfing on the 12 best courses in the word, or engaging in a worldwide search for a master criminal has been with us long enough to soak into the popular culture.

Virtual reality is another, related development that extends technology's impact on what we may experience. Virtual reality maximizes sensory involvement in increasingly realistic and compelling simulation-like interactive environments, allowing a participant to, in the words of Nolan Bushel (1986), "be there." In the glow of fascination with the ability to supply such experience through technology, the technoromantic often forgets that to experience everything first hand takes too long. We often read about or engage in other abstractions to save time: there is not time enough to experience it all firsthand.

The cognitive operation of forming concepts is a means of protecting us from experiencing everything directly. Once a person knows "chair-ness," the experience of seeing a chair never seen before looses some of its luster. The jaded chair-knower can go about in a world filled with countless kinds of chairs with hardly a second thought to each new chair, except to be sure it is in the right place before sitting down. There is a fundamental trade-off at work: we trade off the joy of experiencing a new world filled with new wonders at every turn for the power and efficiency that knowledge of the world gives us.

Analogous to forming concepts, the phenomena of written and uttered language of all sorts-- verbal, mathematical, musical, visual -- allows condensation and distillation of direct experience. Most of the operations allowed by language systems can be performed without them, but at impossible expense in time requirements. It is perhaps most fundamentally the time problem that makes it ludicrous to imagine a reform in human interactions, activity, and learning that would be based on the elimination of all things not part of direct experience.

Altering availability and quality of experience through technology is not a particularly new thing. In the 1930's and 40's, the progressivist movement sought to improve education through a greater concentration on student's experiences. Dewey's work on the role of experience in learning (1919, 1938) forms the philosophical basis for much current thinking in experience-centered learning.

Dewey's thinking was not directed at instruction, per se, but was a broader conceptualization of education as an enterprise to serve democracy. Yet, his insistence on the requirement of education to be built from and serve the needs of individuals as opposed to external, traditional academic sources, is a thread that runs through current educational thought. Dewey's thinking on experience was not merely based on the need for relevance but also in a fundamental sense, tied closely to a rational, reflective thinking pattern or "scientific method," citing that method as "the only authentic means at our command for getting at the significance of the everyday experiences in the world in which we live." (Dewey, 1929)

Instructional technology provides us with a changing conception of the role of experience. A long-standing orientation of many classroom teachers, against which instructional technologists have struggled for many years, has been the planning and provision classroom experiences without sufficient attention to what sorts of learning those experiences might lead to. An instructional design orientation to improving teaching has suggested reevaluating an "activity for activity's sake" orientation to teaching. Instructional designers have suggested rather than teachers and curriculum developers consider the potential outcomes of traditional activities. In contrast, current thought as embodied in the constructivist movement sometimes emphasizes richness of experience as an end in itself. According to some theorists, experience has become the objective for constructivists. Learning is said to be in the experience, not a product of the experience. How we come to know is seen to be in our interactions with the environment, not a product of those interactions (Duffy, 1994).

We concur with the important contribution to the quality of learning that situated cognition, authentic tasks, and other constructivist tenets can bring to learning from instruction. There have been countless instances of learners suffering from "un-authentic" instruction that leaves the learner with no internalized, meaningful body of knowledge or skill. Such appears to be the case with much of mathematics learning in the United States today. It seems clear that there is a critical need for tools that will help learning become meaningful, and it appears that situated cognition and other constructivist tools represent true progress in this direction.

The difficulty we face is a lack of sufficient work on when, and under what circumstances these tools or approaches should be used. Some alternative conceptualizations could be explored:

1) Approach all instruction from either extreme, only information, always direct, everyday experience. We reject this alternative out of consideration for the requirements imposed by certain interactions of learners, learning tasks, and often other factors from instructional needs, settings and the like. Other considerations may also tip the choice, including those for need for efficiency of learning that may override needs for meaningfulness and interest. Medical schools may choose not to break each bone in the bodies of students who are specializing in orthopedic surgery. Or, as Winn has noted: "I am not convinced yet that all knowledge can be constructed by students. The student must have some knowledge from which to start instruction, and that knowledge must be explicitly taught." Winn (1992)

2) Never acknowledge one of the extremes as a means to learning. We reject this alternative based on consideration of the unquestionable value of direct experience and raw information to learning. However, we would not term these extremes "instruction."

3) Sometimes use experience-rich or information-rich strategies, depending on the situation. This is the position we wish to work from, leaving the question, what would guide us in deciding when and under what circumstances will working at the extremes be useful? The task, it seems to us, is to learn more about what interacts with situations and instructional strategies.

Information

Popularly available information in recent years has changed from static to dynamic, from carefully gatekept to open, from delayed to immediate, and from structured to free-form. We see this information resident in hypermedia, databases, computer networks and bulletin boards, and in information storage media, such as CD ROM technology. This information can be timely, provide contrasting perspectives, and provide extreme depth and detail in coverage. To those having strong information needs, never has information been so rapidly available.

Exploration in information-rich, hypermedia environments has been seen by some as a solution to educational problems. However, provision of access to information, regardless of how deep or elaborate, is not in and of itself sufficient for instruction. All of the issues that the constructivist movement has so forcefully put are germane: meaning does not reside in the message, ideas are not "transferred," individuals must organize or "construct" information in ways that are personally meaningful. This task can be overwhelming when working from an information-only base, or as Perkins described it, having a "high price in the cognitive economy" (1992).

Some research seems to support the suggestion that pure information may not be sufficient to support learning. For example, Jacobson, Kolar, Maouri, Mishra and Spiro (1994) investigated learning in hypertext environments and found that learners in a no-guidance condition were overwhelmed and not as successful as learners provided with guidance. "The mere availability of nonlinear hypertext links may not be sufficient to affect substantive learning outcomes." (p. 17)

Some limitations inherent to information-based learning systems include the expectations of learners' abilities to select, evaluate, sequence, and structure this information anticipates new levels of text processing and other learner strategies that may not be presently available in many learners' repertoire. Other characteristics possessed by novices in a domain severely limit the usefulness of unguided exploration in information bases.

Instruction

The technology of printing reduced demands on learners from that of direct experience or the vicissitudes of oral tradition, and the technology of instruction/teaching has offered a guiding hand through the world of information. The term, "instruction," never well-understood, seems to be taking a new meaning, one that is far from its rich meaning in the context of instructional technology. A frequently-observed trend is to consider instruction as referring to only a specific sort of strategies, ones of a didactic or reception-learning sort. By some, instruction is perceived as something "done" to learners, rather than something that is "participated in" by learners. We consider instruction to include a range of strategies that facilitate experiences that are expected to lead to learning.

Instruction may be seen to reside between two poles: experience and information, and should involve a process that involves both sources of learning, as the situation requires. On the continuum presented earlier, we place instruction in the range between everyday experience and transmission of information. Indeed, we describe instruction in this arena, to be the facilitation of contrived experiences. These contrived experiences can range from "being there" as in participating in the Boston Tea Party to selecting and reading

excerpts of diaries of British and colonial participants and observers of the Boston Tea Party, to reading historical analyses of this event and evaluating or reacting to them.

Instruction that is all experience is at risk of being vapid and impractical, or too limited in scope or example-provision to allow transfer. Instruction that is all information may be irrelevant and meaningless. Choices between the two sources as well as other essential ones in fostering learning are implicit in instructional design. The richness of experience and information that computer-based learning environments can now provide is seductive in appearing sufficient to learning, in much the same way that motion picture films were seductive to educators of the 1920's and 30's. Fascination with the power of a technology should not distract us from learning to harness the technology for learning rather than worship it. Critical in these instructional decisions are evaluating the nature of the learners' prior knowledge, motivations, beliefs, as well as the nature of the potential learning outcomes.

A question, illustrative of our concern, is what forms of learning guidance are needed in exploratory learning situations. We are currently engaged in empirical studies on this topic, in which varying forms of support are employed in exploratory, computer based learning environments. Our preliminary results are pointing to a particular needs for support for novice learners, different from the needs of learners with prior knowledge or skill.

In an article on conditions that foster student engagement in productive autonomous learning activities, Thomas and Rower (1993) provide a set of course-specific facilitators including the explicit articulation of demand conditions and support practices, the provision of authentic self-directed learning responsibilities and tasks, and opportunities to assess the effectiveness of existing strategies and to learn new ones.

Often the provision of the paired situations, as exemplified in the Jasper series (such as Journey Down Cedar Creek), while rich and engaging, fails to provide application of skills in more than one context, decreasing the odds of transfer. We would not avoid the Journey Down Cedar Creek (though a question exists as to how "authentic" a situation a boat trip might be to many learners, such as those from inner city environments), but would question its adequacy, hoping to extend it with practice using multiple examples.

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