



Project 2

Book Chapter – Instructional Systems Design

Context

This book chapter was written as a collaborative effort with Professor Charles M. Reigeluth during the Spring of 2002. The book chapter will appear in the book “Education Technology and Beyond,” scheduled for publication in late 2002.

Conditions

In writing this chapter, I used many of the resources I had acquired during my doctoral studies at Indiana University, especially readings from several courses and the doctoral reading list.

Scope

This 5000-word chapter is currently being reviewed by the book editor. The chapter covers the present state of instructional design, describes obstacles and catalysts to more comprehensive implementation in education, and projects some areas where the authors expect advances in technology to move instructional design field forward in the near future.

Role

My role as first author included writing the first draft and collaborating with Dr. Reigeluth on subsequent reviews and revisions.

Included Excerpt

In this portfolio, I have included the chapter outline, and an excerpt from the final major section of the chapter.

Book Chapter: Instructional Systems Design

I. What Is Instructional Systems Design?

- A. Introduction
- B. Descriptive Vs. Design Theory
- C. New Demands On Instructional Theory
- D. Promising Types Of Theories
 - 1. Self-Regulated Learning
 - 2. Problem-Based Learning
 - 3. Social Interaction
 - 4. Simulations
 - 5. Instruction For Affect
- E. Universal Principles Of Instruction

II. Implementing ISD: Limitations and Opportunities

- A. Introduction
- B. Systemic Problems and incompatibilities
- C. Obstacles to Implementation
 - 1. Teacher Training and Interest
 - 2. Evaluation Systems
- D. Leverage Points and Catalysts
 - 1. Technology-Enabled or Enhanced Instruction
 - a. CSCL Systems
 - b. Online Systems
 - 2. New Evaluation Systems
- E. Design Theory - Easier to Use

III. Into The Future

- A. Accelerating, Deepening
 - 1. Virtual Reality
 - 2. Ubiquitous Computing
 - 3. Web-Based Instruction

4. Learning Objects
 5. Multi-Channel Learning
 6. Knowledge Management
 - a. Just-in-Time Learning
 - b. Electronic Performance Support Systems
 - c. Embedded in Authentic Performance
- B. Formative Research to Create Design Theory
- C. Conclusion

Section III. Into The Future

Accelerating, deepening

We expect the paradigm shift described earlier to continue, accelerating and deepening as changes affect all aspects of life. Contributing to this shift will be advances in the power of technology, increased access to technology and services, better understanding of how to use technology effectively in education and training, and new ways of both instructing and designing instruction based on the learning-focused instructional theories discussed previously. We believe that several areas of research and practice are likely to have a particularly important influence on the development of future instructional theories: virtual reality, ubiquitous computing, Web-based instruction, learning and knowledge objects, multi-channel learning, and knowledge management.

Virtual Reality

Virtual reality (VR) instructional systems use high performance computers and newly designed interfaces to provide virtual – as opposed to actual – experiences to learners. VR systems commonly use wearable computers and displays in their attempts to immerse the learner in an experience as close to actual as possible. The goal is for the learner to suspend his or her disbelief and interact with the instructional environment as if it were real. Potential instructional applications for VR include those similar to simulations: where the “real” learning experience is not readily available due to access, expense, safety, time requirements, or some other constraint (e.g., exploring the interior of a glacier). Since many applications of VR rely upon powerful and complex computing systems, we expect that VR systems will become more prevalent in instruction as computer technologies advance and become less expensive. As powerful VR systems become available, more instructional methods for making best use of them will surely be developed.

Ubiquitous Computing

Ubiquitous computing refers to computing applications that are so common that they seem to be everywhere, part of the general landscape of life. These applications may be embedded in larger systems, often performing their function without being noticed at all, as in our cars, for example, and our TV sets. In schools, computers were once relegated to computer labs and the library. Now, computers are in classrooms, homes, libraries, museums, backpacks, and sometimes even shirt pockets. And coupled with telecommunications and the Internet, those computers increasingly allow access to instruction any time and any place. This is placing new demands on instructional theory.

Web-Based Instruction

Web-based instruction has emerged over the past decade as one of the most important developments in instructional technology. Learning “online” will continue to become more common, both in formal instructional settings and informal learning environments. Since the early 1990’s, the capabilities of the web have evolved from simple presentation of information to dynamic, interactive, multimedia presentations and rich learning environments that facilitate social interaction and enable collaboration. To take advantage of these expanding capabilities, instructional theory must develop guidance on ever better ways of teaching and learning that focus on collaboration, social interaction, and multiple experiences with content to reshape the learning experience.

Learning Objects

A recent development in education and training places an emphasis on creating reusable “learning” objects (RLOs, or sometimes just “learning objects”) and building instruction by combining RLOs in different ways to meet one’s instructional objectives. Usually, each RLO is designed to “teach” one complete learning objective and includes instructional media (text, graphics, animations, etc.), practice, feedback, and assessment as needed. The Advanced Distributed Learning (ADL) initiative, sponsored by the United States government, is coordinating a major effort to standardize the creation and technical labeling of learning objects so that each is reusable in as many specific contexts as possible. The ADL initiative has created the technological foundation that will enable the widespread reuse of RLOs, but there has been little emphasis on how best to design instruction using them. This is a major challenge for instructional theory and research.

Multi-channel Learning

Multi-channel learning involves the use of multiple channels of instruction, such as formal school, after-school tutorial programs, parent-assisted homework, audio or video lessons on tape, and distance learning media. The goal of multi-channel systems is to provide the most effective mix of instructional channels to each student. Some forms of multi-channel learning have been practiced for a long time in many cultures around the world, but formal recognition of multi-channel learning as a legitimate “educational program” option began only in the early 1990’s. This approach has been very effective in several large educational programs, including the INNOTECH program in the Philippines, the India Open University, and the OLSET program in South Africa (Anzalone, Sutaria, Desroches & Visser, 1995). This is an important approach for instructional theory to address.

Knowledge management

Knowledge management is an emerging field concerned with the management of knowledge in an organization, especially as it relates to employee performance. Knowledge management systems are designed to identify and capture relevant information (knowledge) from expert employees, and then transfer that knowledge to those who need it in order to perform well, quite often the less experienced employees. One of the most useful functions of successful knowledge management systems is their ability to manage “just in time” learning requirements.

Just-in-time Learning

“Just in time” knowledge management systems specialize in providing just the needed information (knowledge) at just the right time to the requestor. For example, experienced maintenance personnel repairing complex machinery, such as an airplane, may need just a small amount of very specific information to complete their task, but they need it immediately. In a classroom, a student may be struggling to learn a new complex cognitive skill, such as using the second derivative to calculate the speed of a particle. A just-in-time system might recognize a point of difficulty that the student is experiencing and provide a helpful suggestion or a slight correction, enabling the student to learn the skill. Just-in-time systems complement more traditional training systems that provide knowledge “just in case” the student needs it at some point in the future. Typical classroom instruction falls into the just-in-case category, but a great deal of the knowledge may never be needed for actual practice, and students are typically less motivated for just-in-case instruction. This has led to the recognition of the value of just-in-time instruction, and instructional theory should take this into account.

Electronic Performance Support Systems

Electronic performance support systems (EPSSs) are a powerful tool for just-in-time learning. They can provide workers with just the right type of information (e.g. conceptual explanations, steps in a procedure, or past performance data) at just the right place (e.g. on the shop floor, as part of a computer software screen, or at the site of an experiment) in just the right amount and at just the right time. EPSSs can support levels of employee performance that may not normally be possible due to the complexity or sheer volume of information. This is an important function as many jobs increase in complexity and the volume of information increase in the Information Age.

EPSSs may be standalone systems or may be embedded in the performance tool itself. For example, an EPSS may be designed to assist teachers in choosing from among dozens of possible instructional theories and methods. Another form of EPSS is the “Help” system packaged as a menu selection in the main software package.

Embedded in Authentic Performance

Knowledge management systems are focused on authentic practice that is embedded in job performance. One of the main challenges in corporate training environments is to capture the corporate knowledge that is distributed (or shared) among the experienced employees and transfer that knowledge to newer, less experienced employees. The “communities of practice” perspective can facilitate this transfer of knowledge.

Communities of practice form when people carry out practices in social groups on a regular (and often frequent) basis. Communities of practice include members with varying levels of expertise, from the experts, who form the core of the community, to the novices, who are just starting to learn the practices of the community (Lave & Wenger, 1991). Sometimes, instructional designers are asked to “design” a community of practice. However, communities of practice are complex social organizations that are not well understood. Much more research and instructional theory development are needed.

Given the options for a knowledge management system to use communities of practice, EPSSs, or some other type of system, instructional theories are needed to help instructional designers decide which options to use and how to make best use of each.

Formative research to create design theory

Given the need to develop a wide variety of additional instructional theories for the information age, we would like to address the use of formative research to create such theories. The formative research methodology is a relatively new research method that can be used to create or improve existing design theory through testing its application in a specific case. This type of research aims to determine what methods work well in the theory, what methods don't work well and thus need to be improved, and how the design theory can be improved.

Formative research is a kind of case study research, action research, developmental research, and grounded theory development. The underlying logic of formative research, according to Reigeluth and Frick (1999) is that ... if you create an accurate application of an instructional-design theory (or model), then any weaknesses that are found in the application may reflect weaknesses in the theory, and any improvements identified for the application may reflect ways to improve the theory, at least for some subset of the situations for which the theory was intended. (p. 636)

In formative research, there are six major steps that the researcher follows (Reigeluth & Frick, 1999): 1) choose an existing design theory, or delimit the scope for a new theory; 2) design an instance (case) of the theory or select a case within the scope; 3) analyze the case in order to identify what works well and what needs to be improved; 4) identify improvements for the case based on formative evaluation data; 5) repeat the data collection for another part of the case or another case entirely, to explore whether the

improvements generalize within the scope of the theory, and repeat the cycle again; and 6) suggest improvements for the design theory based on the experience of the case. There are variations in these steps depending on: a) whether the design theory already exists or is being developed from scratch, b) whether the case is created by the researcher or is/was created independently, and c) whether the case has already occurred or is occurring as the research is being conducted (Reigeluth & Frick, 1999).