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Development of Design Guiding Principles For Constructivist-Based Distance Learning Environments

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Introduction

K-12 teachers are struggling to design effective learning environments that meet the future needs of their students. A number of individuals have suggested that a relatively new theory of learning, constructivism, supports visions of the 21st century, technology-rich, classrooms. The role of technology in the learning process has steadily increased as access has opened classrooms to the world providing teachers and students with expanding learning opportunities. The advent of increased access to world-linking technology has increased the use of distance education to enrich and expand the learning landscape for students. To support and facilitate teachers responses to these changes in their classrooms, this project sought to identify a core of instructional design guiding principles for constructivist based distance learning environments. A panel of knowledgeable individuals in the areas of constructivism and technologically mediated education participated in an electronic study. The information produced by the study will be used to further identify designs, examples, and elements for teacher will be available for planning of inservice experiences and mentoring processes in the future.

Constructivism and Technology

Discussions about the appropriate role of technology in the learning process have increasingly stressed a theory of learning: constructivism (see e.g., Duffy, Lowyck, & Jonassen, 1993; Jonassen, 1996; Wilson, 1996). Constructivism focuses on the personal development of knowledge and learning; it describes both what knowing is and how one comes to know. Students are engaged in learning tasks that allow them to self select learning paths. As they move down their paths, they attempt to make sense of new information and experiences by transforming and organizing encounters in relation to their own knowledge bases. Teachers serve as learning facilitators for the students, providing feedback and guidance during the learning process. As much as possible, the learning environment replicates authentic and legitimate work, providing students with opportunities to learn within settings connected to the world outside school

(Sheingold,1991). The relevance of these settings is thought to provide motivation because the student perceives them as real instead of the artificial memorizing of inert bits of knowledge. The focus is on the construction of personal knowledge in a context similar to that in which the knowledge will be applied (Savery & Duffy, 1996). When something is being constructed, the tools to support that construction become important.

Technology is one of the tools impacting society and, as such, education. As one looks towards the contexts that will evolve in the 21st century, there is little doubt that technology will play a key role. Peck and Dorricott (1994) suggest several reasons for the use of technology in the school setting:

1. Students need access to high level and high-interest courses.
2. Schools need to increase their productivity and efficiency
3. Graduates must be globally aware and able to use resources that exist outside of school.

As it is increasingly accessible, distance education, a combination of technology and education, can help educators to meet these needs. State-mandated curriculum reform efforts, particularly increased high school graduation or college admission requirements, are driving many efforts towards distance education due to two factors: (a) Specific educational needs can be met, and (b) Recent rapid development of technology has resulted in systems that are increasingly affordable (Office of Technology Assessment, 1989). Distance learning networks have become important due to their ability to expand both the classroom and access to the available learning resources.

In the past, distance education was conceptualized as an industrialized form of education with instructional materials packaged for the purpose of delivering instruction to a remote learner (Keegan, 1986, p. 47). Today, emerging technology, with its increased bandwidth, interactivity, and accessibility, is opening numerous opportunities for students, teachers, and information to

interactively mesh in the construction of knowledge. Emerging technology is allowing a reconceptualization of the concept of distance education. Innovative types of pedagogy enabled by these emerging media, messages, and experiences make possible a transformation of conventional distance education (i.e., replicating traditional classroom education) into alternative instructional paradigms (Dede, 1995). Methods used to optimize instruction by tailoring content to the communications characteristics of the medium are important issues under discussion (See e.g., Mehlinger, 1996; O'Neil, 1995; Sheingold, 1991). To acknowledge that both learning and teaching are under scrutiny, Sheingold (1991) labels the discussion as an approach to active learning and adventurous teaching (p. 19).

Much time and effort has been spent defining and discussing constructivism (See e.g., Duffy & Jonassen, 1992; Duffy, Lowyck, & Jonassen, 1993; Wilson, 1996) and technologically mediated education, of which distance education is a key component (See e.g., Dede, 1991; Willis, 1994; Portway & Lane, 1994). Little discussion has addressed the combination of the two entities, or the skills teachers may need to implement their combination, into a constructivist based distance education program. This study brought together experts in constructivism and technologically mediated learning for the purpose of developing a set of design guiding principles to be used, in a later study, to identify the elements a teacher must possess to responsively create, facilitate, and evaluate these learning environments.

Method

Research Design

The purpose of this study was to identify a set of design guiding principles for constructivist based distance learning environments. A panel of 14 knowledgeable individuals in the areas of constructivism and educational technology agreed to participate. Respondents provided input via instruments located on a WWW site. Three constructivist propositions were used to guide the development of the necessary WWW pages for the study (Savery & Duffy, 1996, p. 135):

1. Understanding is in our interactions with the environment. Because understanding is a function of interaction of the content, context, the activity, and the individual a context was created to serve as a vehicle for the study. The School District #627 Instructional Support Project was identified as a fictitious project to develop an outline of the necessary knowledge and skills for teachers to design and implement constructivist based learning environments in schools without walls, a virtual school district.
2. Cognitive conflict or puzzlement is the stimulus for

learning and determines the organization and nature of what is learned. The placement of the panel within the project context provided the purpose for the study. The identification of the knowledge and skills provided the stimulus for knowledge construction.

3. Knowledge evolves through social negotiation and through the evaluation of the viability of individual understandings. The social environment of the study and the use of the WWW provided the panel with opportunities to see and respond to each others anonymous responses. The iterations of the study allowed the negotiation of the construction of the final product of the study.

Findings from the study will be answer following question: Can a series of design guiding principles be identified to assist teachers in the creation, facilitation, and assessment of constructivist-based, interactive, distance learning environments?

Panel Membership

Panel members for this study were chosen from the following areas of expertise: (a) Constructivism; (b) Technologically-Mediated Education; (c) Instructional Design; (d) Learning Environment Design; and (d) Virtual Environments. Identification came from four sources: a conference proceedings search, an ERIC search, a library search, and conversations with recognized leaders in the fields. From these searches, 23 individuals were identified. Fourteen people agreed to participate. Thirteen of the panel members were from a university setting, one was from private business.

Instrument

All instruments were available on the School District #627 Instructional Support Project World Wide Web site. A previously expressed concern about formatting problems during an electronic-mail based research study (Bell, 1992) and a concern about ease of replying, lead the researcher to the use of the World Wide Web. The WWW was chosen because: (a) it can be designed to provide a simplified interactive environment thought to encourage input from the panel; (b) it provides a more standardized format for viewing the pages; (c) it has the ability to hyperlink pages which facilitates the setting of the context and connections to support documents; and because (d) it allows the flexibility of adding follow-up iterations while still maintaining previous ones for the panel members edification.

A concern noted in the planning of this project was the possibility that outsiders to respond to the Delphi and confound the study. A WWW grading program, Classnet (Boysen & Van Gorp, 1996), was incorporated into the

project to guarantee anonymity and reception of only authorized responses. Classnet requires an alias before answers can be submitted, thus outside interference was eliminated.

The context provided was the fictitious School District #627 Instructional Support Project. The School District #627 Instructional Support Project scenario was explained as follows: For the first time in its history, K-12 School District #627 is able to preplan all components for a student's educational experience. The results of the project will be used to guide inservice activities for the districts teachers. Over the last 3 years, the city served by School District #627 has been wired for interactivity with a fiber optic system called the Virtual Network (VN). As the city began planning for the VN, the school district began planning for their transition to a school district without walls—a virtual school district. The district has access to and the financial resources for use of any type of distance technology they choose. There are no limits on the resources (technological or otherwise) available; the only parameter is that the learning setting offer interactivity to its participants. After a series of meetings with educational stakeholders and learning consultants, the district has selected constructivism as the philosophical foundation for learning in the new classrooms (Herring, 1996). The intent of the context was to frame the discussion, and yet, leave it open to the areas of expertise of the panel members. The scenario was left broad enough to allow visioning for future technology (i.e., any type of distance technology) while clearly situating the discussion in a K-12 constructivist based learning environment.

Almost all communication was carried out via the computer, using email and the WWW. Phase One of the Delphi provided for the social negotiation of the design guiding principles. The Constant Comparison method, which grounds the final product (in this case, the final set of designs or examples and their elements of implementation) in the joint constructions of the respondents, was used to guide the development of the instruments for phases two and three responses. The joint construction emerges as the panel moves towards consensus on the final product through the iterations of the Delphi (Guba & Lincoln, 1989). Thus, the final product is grounded in the individual responses of each panel member.

The Study

Phase One

For the first round, several pages were put on the web site. A graphic interface opened the site, allowing quick movement to other pages; an introductory page set the context for the Instructional Support Project; and a Delphi/Definitions page offered clarification of the

research process and terms. The Phase One instrument offered five design guiding principles for constructivist based distance learning environments for review and comment by the panel. The five principles were developed using tenets of constructivism that were established through a review of 14 constructivist based articles. Panelists were notified of the project start through email. Email reminders were sent out twice during this phase.

The five original principles were:

Design Guiding Principle 1: Anchor instruction using authentic problems and simulations that have relevance or can become relevant for students and that actively engage students in the design of knowledge.

Design Guiding Principle 2: Encourage students to collaborate during the learning process, thus providing the opportunity for increasing students' favorable attitude towards the importance of visiting content and problems from multiple perspectives.

Design Guiding Principle 3: Grant students responsibility for the learning process and for creating understanding; seek and value students' points of view and experiential backgrounds in developing or creating dynamic, challenging learning environments appropriate for the student's level of expertise.

Design Guiding Principle 4: Promote student reflection about both the content learned and the learning process by incorporating individual and collaborative feedback during student articulation, presentation, and revision of ideas.

Design Guiding Principle 5: Make assessment dynamic, evolving from students' use of the competencies and reasoning processes that address the goals of the learning environment, while locating it in authentic contexts and integrating it into the instructional design so that the assessment is embedded in the instructional process.

Phase 2

In Phase Two the original principles were reordered and rewritten to reflect input from the panel. Phase Two WWW additions contained pages with panel members responses to Phase One, justification for changes to the five principles, and the Phase Two instruments. A general comment box was added at the request of several panel members. The design guiding principles were revised to reflect panelists input. Following is a listing of the five principles and an explanation of the changes:

Principle 1: Given an understanding of and positive attitude towards constructivism: Provide learning experiences which promote student reflexivity about both the content learned and the learning process in order to develop the student's self-awareness of the constructedness of knowledge and the student's self-control over the learning process.

Explanation of change: The original Design Guiding Principle Four was moved to the first position because several respondents identified that it addressed the basis of constructivism: metacognition. A term from Cunningham, Duffy, and Knuth (1991) reflexivity (i.e., a reflection of our reflections, thinking about our thinking process, knowing how we know), instead of the term multiple perspectives, was used because it was provided an expanded definition of intent of the learning process. Several respondents identified this principle as critical aspect, essential component, and heart of it which also made the move to #1 appropriate.

Design Guiding Principle Two: Create dynamic, challenging learning environments which are appropriate for the student's level of expertise, development, and culture and which encourage, facilitate, and support student's taking ownership of the learning process.

Explanation: Principle Two takes into account the learner in the design of the learning environment. Since constructivists identify that knowledge construction is a function of one's prior experiences, mental structures, and beliefs that are used to interpret object and events (Marra & Jonassen), the learner must be an early and integral piece in the design and implementation of learning environments. The wording was changed because panelists felt the wording targeted increasing students favorable attitudes rather than the importance of multiple perspectives. Social negotiation of knowledge was used to be more encompassing including not only multiple perspectives but identified topics such as collaboration.

Design Guiding Principle Three: Given a relatively defined domain of knowledge and learning goals, design authentic instruction situations that have relevance or, through teacher mediation, can become relevant to students and that actively engage students in the construction of transferable meaning.

Explanation: Principle Three addresses the need to create learning environments in a context that the student would see as potentially creating useable (i.e. transferable) knowledge. Because the learners come to the environment at varying levels from novice to expert, it was identified that the opportunity for teacher mediation should be included. Several respondents found that the original principle seemed to address multiculturalism rather than learning environments where students can move about in their own learning levels so wording was restructured to focus on students entry level rather than ethnic diversity. A number of respondents mentioned the need to address the role of the instructor as the facilitator of learning, thus in Principle Two (encourage, facilitate, and support) and in Principle Three (through teacher mediation) wording was changed to reflect a more appropriate role for the instructor.

Design Guiding Principle Four: Develop learning experiences which encourage the social negotiation of knowledge to provide learners with the opportunity to evaluate individual understandings of concepts and to expand individual and shared understandings.

Explanation: Principle Four speaks to the importance of interactions within the environment. The interactions would naturally occur after the relevancy of the learning was identified by the students. The original Principle Two (the new Principle Four) wording was identified as targeting increasing students favorable attitudes rather than the importance of multiple perspectives. The social negotiation of knowledge replaced increasing students favorable attitudes, to be more encompassing including not only multiple perspectives but topics such as collaboration and others. Both cognitive constructivist and sociocultural constructivists address this issue as important (Fosnot, 1996).

Design Guiding Principle 5: Given an understanding of and positive attitude towards constructivism: Use dynamic, authentic assessment that is embedded in the instructional process to assess both student learning and the learning environment.

Explanation: Principle Five deals with assessment. Constructivists believe that assessment of learning should evolve out of the learning process through the negotiation between student and teacher thus, it would be logical to have it follow principles dealing with the learning environment creation and students learning activities. The intention of setting goals was moved from Principle Five to Principle Three because goals support the creation of the learning environment. Thus, they should be mentioned earlier in the principles, thereby, becoming embedded in the assessment of the learning process. Several identified that some of the principles were how to while others were not, so I have attempted to put them all in the same format using action verbs to indicate their use rather than giving instructions on their implementation.

Conclusion

The intent of this project was to identify a set of design guiding principles using a panel of knowledgeable individuals in the areas of constructivism and/or distance learning. Following a two phase project, five final principles were agreed upon. The principles represent a beginning to the combination of constructivist based learning theory and distance education. They provide a foundation that can be used for the further identification of the knowledge a teacher should have to create, facilitate, and assess constructivist based, interactive distance learning environments.

From fiber optic networks to the World Wide Web, the interactive nature of new distance learning technologies provides students and instructors with technologies that are intended to be flexible, explorative and open to social uses and whose potentially rich sources of data will be readily available in response to the demands of the learners functioning within an open environment. Their availability for use in life contexts can change the way we work, think, do, and learn substantially.

To respond to the future needs of students, the design of distance education use should be focused on social interactions and communication; intended to support the social, distributed and situated construction of new knowledge. The development of constructivist based distance learning environments can embody this design. The design will not occur simply because instructors have access to the new technology. Instructors must be introduced to the nuances of integrating new ways of constructing learning with the new more powerful distance settings to provide students with the tools necessary for effective participation in the 21st century. Mehlinger (1996) creates a succinct picture of the imminence of technologies impact: If you believe that schools are part of the American culture, that the American culture is increasingly influenced by Information Age technology, and that teachers participate in the American culture as much as other Americans, then you cannot also believe that teachers will use the technology outside of school but fail to employ it in their classrooms. Technology will be used extensively in schools. That much is inevitable (p. 407).

Considering the nature of distance education, with students expected to shoulder more of the responsibility for learning, and the capacity of emerging technology, with its increased capacity to support learning, the marriage of constructivism and distance education seems a likely fit.

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