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ABSTRACT

This paper examines some aspects of a graduate course in educational technology at the University of Regina (Saskatchewan). The focus of the course (offered in the fall 1999 semester) was to examine how aspects of learning theory can impact the use of technology in schools and to develop a theoretical model that could drive and reflect appropriate ways for technology use in the classroom. Topics covered in the class included belief systems, two theoretical models (i.e., communities of learners and situated cognition), and organizational frameworks. The paper describes the course content, provides an overview of the processes involved in developing the theoretical model, and proposes characteristics of a model for effective technology-curriculum integration that addresses the role of the teacher, the role of the student, subject matter, and the environment. (Contains 11 references.) (Author/MES)

The Impact of Theory on Technology Use in the Classroom

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Abstract: This paper examines some aspects of a graduate course in educational technology at the University of Regina, Canada. The focus of the course (offered in the Fall 1999 semester) was to examine how aspects of learning theory can impact the use of technology in schools, and to develop a theoretical model that could drive and reflect appropriate ways for technology use in the classroom. In this paper we describe the course content, provide an overview of the processes involved in developing the theoretical model, and propose characteristics of a model for effective technology-curriculum integration.

Description of the Course

The course under discussion in this paper was designed for graduate students who are familiar with basic computer-related technology skills and concepts and their pedagogical appropriateness in the K-12 classroom. Specifically, the course was designed to explore the effective integration of the Internet into the curriculum. Students examined ways in which the Internet might be integrated into the curriculum, analyzed different learning theories to determine which (if any) related to the current (or future) use of the Internet in the classroom, and developed a working learning-theory model that could be used to influence the appropriate use of the Internet in the classroom. Modules on various topics were presented by groups of students who were expected to participate as *students* on WebCT by contributing to the chat room and Bulletin Board, and as *instructors*, by creating directories and pathways through which they posted the various course modules on WebCT. A WebCT course developer expert gave the class a summarized overview of how to create pathways and directories, and of how to upload documents. This was helpful for learning the technical aspects of WebCT. After the initial orientation to the course and WebCT, we began the process that would lead to the development of our theoretical model for technology integration.

The entire course is posted on WebCT at the University of Regina site [http://webct.uregina.ca:8080/ – click on course listings, then on "Internet and Curriculum Integration" and then log in as a guest; (user id: *guest*; password: *guest*)].

The Importance of Theory

Richard Skemp stated, "There is nothing so practical as a good theory." (Personal correspondence, 1991). He states that "an essential feature of a theory is that it helps us to understand the invisible causes which lie

beyond the visible effects" (1989, p.46). The abstractness and generalities of theories gives them their power to be practical. In our class discussions, we were led to believe that a theoretical model for technology-curriculum integration could be general and practical and could be used to drive and reflect the effective use of technology in the classroom. We therefore embarked upon a quest to create a theoretical model for the effective use of technology in the classroom.

The Process of Developing a Learning Theory Model

We began the process of developing a theoretical model by examining how the provincial on-line curriculum is attempting to integrate technology into and across subject areas. The Evergreen Curriculum is located at http://www.sasked.gov.sk.ca/docs/evergrn.html. One of the on-line curriculum designers presented the class with an update of all the new features on the first night of class. The course instructor also led the class through some introductory theoretical work that was a review of different belief systems, and an overview of two different models of learning. Small groups of students choose topics that they would research, present in class, and post on WebCT. Topics selected for review by students were:

- Learning Theory.
- Virtual Architecture
- Filamentality
- Virtual Environments

The first of these topics examined current learning theory and the other three focused on some popular ways in which educators have organized Internet-related frameworks for technology-curriculum integration.

Using Schwab's (1973) Commonplaces as the heuristic, we compared the respective roles of the teacher, the student, the subject matter, and the environment as they apply to two belief systems or paradigms and two current learning theories. We then looked at some frameworks for integrating technology into the curriculum and attempted to analyze these to determine which theory of learning (if any) could be identified. We also compared articles by supporters and critics of technology and noted some of the issues related to the appropriate use of computers in the classroom. We also discussed what a classroom might look like where technology was being successfully integrated. We took into consideration what we believe to be the most essential, most appropriate, and most effective features of a technology-rich classroom environment, based on the presentations of the groups, the issues arising from the critics and our on-line and in-class discussions, and our own experiences as teachers. These considerations contributed to our theoretical model. The following is a summary of the topics presented in class.

Belief Systems

Although there are several philosophies concerning what and how students should learn, two beliefs systems or paradigms primarily influence our current teaching practices. The most widely influential has been the objectivist paradigm (frequently known by other names such as traditional, transmission, teacher-centered) where the teacher's role is to teach – that is to dispense or transmit knowledge. It is the teacher who determines what is to be taught and how it will be transmitted. The student follows the teacher's direction, learns the information and gives it back. The subject matter is generally pre-determined and is often developmental and specific. Evidence of knowledge acquisition is determined by observable outcomes and behaviors exhibited by the student. The learning environment is generally structured where students work independently.

The second paradigm that has had the most impact on teaching, though not as widely practiced as the former, is the constructivist (practical, interpretive) paradigm. It is based on the premise that students learn best when the subject matter is meaningful and related to their interests and experiences. The teacher's role in this orientation is one of a guide or facilitator who provides a stimulating learning environment that promotes hands-on experiences, intellectual risk-taking, and cooperation. The student's role is to be inquisitive, creative, collaborative, and reflective. The subject matter is holistic and customized to the needs, interests, and prior learning of the students. It is often divergent or open-ended with groups of students working in an area of interest. As students reflect on their experiences, they generate "rules" or "mental models" to make sense of their experiences. In other words, they construct

their own meaning from the experiences. In this context, learning is believed to be a process of continually adjusting the mental rules and models.

Two Theoretical Models of Learning

In this course, class members explored two current learning theory models: Barbara Rogoff's *Communities of Learners* (1994), and *Situated Cognition* (Brown, Collins, & Duguid, 1989). We believed these theories to be relevant to technology integration in the classroom.

In the *Communities of Learners* model (Rogoff, 1994) the author asserts that "learning occurs as people participate in shared endeavors with others, with all playing active but often asymmetrical roles in sociocultural activity" (p. 209). This view of learning contrasts with the one-sided learning models typical of European , American, and Asian schools where adults are in control of the learning. It also differs from child-run models that are "based on the assumption that learning is the product of discovery by oneself or *Community of Learners* theory, learning is a process of transforming participation where "both mature members of the community and less mature members are conceived as active; no role has all the responsibility for knowing or directing, and no role is by definition passive" (p. 210). In this view all members of the community are at some time both a teacher and a learner.

Situated Cognition, (Brown, et. al, 1989) has some similarities to the *Community of Learners* theory. Both models acknowledge that learning is best accomplished when it is authentic and related to the interests and experiences of the students. In the *Situated Cognition* model however, the adult serves as a mentor and the student is an apprentice. Learning is considered meaningful only if it is embedded within the social or physical context in which it will be used. One way to create authenticity in learning so that it more closely resembles what practitioners do, is to "enculturate students into authentic practices through activity and social interaction", based on the successful and traditional apprenticeship model (p. 37).

Herrington and Oliver (1997) note that the principal theorists (and critics) of situated learning have identified a number of important characteristics of the learning environment which have added to the evolving theory of situated learning. In attempting to identify those characteristics that are most applicable to the instructional design of interactive multimedia, Herrington and Oliver suggest that the learning environment should:

- Provide authentic contexts that reflect the way the knowledge will be used in real-life
- Provide authentic activities
- Provide access to expert performances and the modelling of processes
- Provide multiple roles and perspectives
- Support collaborative construction of knowledge
- Provide coaching and scaffolding at critical times
- Promote reflection to enable abstractions to be formed
- Promote articulation to enable tacit knowledge to be made explicit
- Provide for integrated assessment of learning within the tasks.

In the characteristics outlined in the cognitive apprenticeship and community of learners models we identified the roles of the teacher, student, subject matter, and environment. It is interesting to note that some of the roles have elements of both the objectivist and constructivist orientations. For a summary of the four commonplaces as they apply to the two paradigms and two learning-theory models see the following site: http://education.uregina.ca/courosa/site2000/overview.htm.

Organizational Frameworks

The next step in our theory development process was to examine the work of educators who have developed frameworks for organizing the Internet and curriculum-related activity. The works of Judi Harris (Virtual Architecture), Bernie Dodge and Tom March (Filamentality), and Chris Dede (Virtual Environments) were of particular interest because of the innovative ways these educators have discussed the use of the Internet and technology in classrooms. We also looked at the work of Cynthia Leshin (Internet Adventures,1998) who has developed an extensive list of Internet resources for teachers, and Seymour Papert (Mindstorms, 1980) , the developer of Logo, the first computer programming system for children.

Judi Harris (1998), and also see her website at http://ccwf.cc.utexas.edu/~jbharris/Virtual-Architecture/, uses the metaphor of a house to organize the ways teachers and students might use the

Internet to extend learning. She compares the rooms in a house to educational activities that can be structured to serve different purposes. And, just as rooms in different dwellings might have similar purposes but can function and look quite differently, so can "the same activity structures . . . be used to help students at different levels and with different curricula learn in differentiated ways that are best suited to their interests and needs" (p.42). Within the "house" are several areas where students can use computers in a variety of ways to accomplish different learning objectives. For example, the basement provides the foundation or rationale for the framework, the kitchen is for telecollaboration, the study for teleresearch, the bathroom for designing projects, and the yard for assessment. For an overview classroom activities that could be accomplished through telecollaboration, see http://rbe.sk.ca/webactivities.

Harris (1999) cautions however, that the activity structures for telecollaboration must be combined with seven action "c-quences" to help the students "plot the steps they will take as they use the activity's structure to engage in active learning" (p. 43).

Bernie Dodge and Tom March created filamentality, an interactive, fill-in-the-blank web site for guiding teachers though the process of designing Internet-based instruction. Teachers pick a topic, search the Web, identify good Internet sites, and turn the Web resources into activities appropriate for learners.

One currently popular aspect of *Filamentality* is the WebQuest. A WebQwest "is an inquiry-oriented activity in which most or all of the information used by learners is drawn from the Web. WebQuests are designed to use learners' time well, to focus [learners] on using information rather than looking for it, and to support learners' thinking at the levels of analysis, synthesis, and evaluation" (Dodge & March), http://edweb.sdsu.edu/webquest/overview.htm). Also see http://www.ozline.com/.

WebQuest is only one instructional method within the Filamentality organizational framework. Other suggestions include creating a *hotlist* of good sites, developing a *scrapbook* with multimedia links and other resources, having the students gather information about a subject through a *treasure hunt*, and developing a *subject sampler* of a half-dozen intriguing sites organized around a main topic. Filamentality offers a variety of curriculum-based activities for all levels of Internet users.

Chris Dede of George Mason University has focused his work on how emerging technologies may reshape our views of distance education into an alternative instructional paradigm – distributed learning (1996, p. 1). He and his colleagues have also worked on the use of ScienceSpace Virtual Realities (VR) to help learners understand complex scientific concepts (Salzman, Dede, & Loftin, 1995). The work on distributed learning is of particular significance to educators as local and regional school governing bodies are looking for ways to reduce the costs of education. Dede believes distributed learning can provide opportunities for "learning by doing" and for interacting with virtual communities in ways that complement face-to-face interactions. He suggests, however, that if distributed learning is to fulfill its potential as an economically viable and pedagogically valuable way for students to learn, research is required on the following issues a) instructional design, b) knowledge webs, c) virtual communities and d) shared synthetic environments. He reminds us that as the new technologies become part of our everyday existence, it will be important to keep a balance between virtual interaction and face-to-face interaction and that the new media "need not eliminate choices or force us into high-tech, low-touch situations" (p. 24). More information on Virtual Environments can be found at http://www.virtual.gmu.edu/index1.htm.

Cynthia Leshin's work provides extensive and practical ideas for accessing web resources. She has also compiled lists of web sites that can be used for a variety of thematic units in a classroom. Her work will save teachers several hours of searching for appropriate web sites when developing WebQuests or other activities where children will be using Internet resources. One difficulty with Leshin's work, however, is that it will quickly become dated as the Internet grows. For more information see http://www.xplora.com/xplora.

Seymour Papert's creation, Logo, which allows children to learn the principles of computer programming by commanding the movements of a turtle on a computer screen, has greatly influenced the development of educational technology and our understanding of how children learn. In *Mindstorms* (1980), he discusses the importance of children being able to manipulate objects in order to increase cognitive development. He demonstrated that children can learn mathematical concepts with computers or 'objects-to-think-with', and that by articulating what they do as they create programs in Logo, they are learning to think about their own thinking. Papert developed the idea of a microworld - an authentic classroom environment created by the teacher, within which specific concepts could be learned, specific questions asked, and where students and teachers could interact and work together.

Each framework described above gave our class several ideas for a model classroom in which technology is successfully integrated. The frameworks also helped us to begin to formulate our own

theoretical model for using technology as a tool for curriculum integration in the classroom. The next step was to determine where the class participants were in their own theory development. We posted some questions to the bulletin board and asked our classmates to respond. We wanted to determine if they were aware of any belief system or learning theory that guided their use of technology in their classrooms. We also wanted to know if their thinking or practices had changed since they had started the course or began using technology in the classroom. Generally, we found that through taking this course or through integrating technology in the classroom, some participants were better able to articulate their teaching theories that had previously been unexamined. Some questioned their existing theories and for others, technology was the catalyst for transforming constructivist beliefs about teaching and learning into actual practice. A summary of the participants' responses can be found at http://education.uregina.ca/courosa/site2000/participants.htm.

Our Theoretical Model

Near the end of the course, a clearer understanding of our personal philosophies of teaching began to emerge. We felt we could finally describe the constructs of a learning theory model that would reflect what we believe to be the effective use of technology as a learning tool in the classroom. These constructs are derived from no single theory or belief. When we examined our working charts to determine the most appropriate constructs for our evolving theoretical model, we selected some from all the theories and beliefs that we studied. Although the model has a constructivist orientation, we were surprised to find that we had included some constructs that are more dominant in the objectivist paradigm. Again, we turned to the Commonplaces to provide the heuristic for our analysis. The chart below briefly summarizes the main characteristics of the model we called the Technology-Curriculum Integration Model.

Role of Teacher is to:	Role of Student is to:	The Subject Matter is:	The Environment is:
• Assess • Be a mentor • Be a teammate • Be accountable • Collaborate • Cooperate • Create • Learn • Mediate • Model • Organize • Plan • Provide support • Share leadership • Take risks	• Assess • Be a mentor • Be a teammate • Be accountable Collaborate • Cooperate • Create • Learn • Model • Organize • Plan • Provide support • Share leadership • Take risks	Authentic • Dynamic • Evolving • Integrated • Interactive • Interests-based • Motivating • Problem-based • Processes/ skills • Products • Project-based • Purposeful • Structured /Open ended • Substantive	• Freeing • Encouraging • Collaborative • Cooperative • Authentic • Relaxed • Structured at times • Respectful • Supportive • Happy

Figure 1 The Technology-Curriculum Integration Model

In our model the roles of the teacher and student are, for the most part, interchangeable. The teacher has primary responsibility for structuring the classroom environment, but students can also participate in the design. As well, the teacher is ultimately responsible for and accountable for the assessment of students, but students can play an active role in self and peer assessment. The subject matter is flexible and determined in collaboration with students and teachers, but again, the teacher must ensure that students are learning the skills and processes outlined in the curriculum. The learning environment might be characterized as 'freedom without license', where students have freedom to make curriculum and learning choices, and are free to choose where and how they work within the context of a structured, respectful, collaborative learning community.

Conclusion

Our intention in this course was to examine learning theory as it related to the effective use of technology in the classroom. In the process of examining theories, we discovered that no one theory is best for guiding technology and curriculum integration. We therefore developed a theoretical model that has components of other theoretical models and belief systems. We came to the conclusion that knowledge of the theory that informs our practice is absolutely crucial if we are to provide meaningful learning experiences for students. As well, theory is necessary if we are to justify our pedagogical decisions, and the importance of technology in classrooms, to those who see little value in using computers in schools. Knowledge of theory helps us to articulate and implement our beliefs about teaching and learning, and ensure that our practices are congruent with theory. Theory is a powerful and practical vehicle that can drive and reflect our practice.

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