INTERNATIONAL JOURNAL OF INSTRUCTIONAL TECHNOLOGY AND DISTANCE LEARNING

December 2004

Volume 1 Number 12

ISSN 1550-6908

PUBLISHER'S DECLARATION

This Journal was established to facilitate collaboration and communication among researchers, innovators, practitioners, and administrators of education and training programs involving technology and distance learning.

An academic institution, Duquesne University, was chosen for its commitment to academic excellence and exemplary programs in instructional technology and distance learning. Duquesne University is supporting the Journal through its graduate program in Instructional Technology and its Center for Technology Education Innovation and Research (TEIR Center). In addition to its educational programs, Duquesne University has major training contracts for industry and government.

The Journal is refereed, global, and focused on research and innovation in teaching and learning. Duquesne University and its partner, DonEl Learning Inc., are committed to publish significant writings of high academic stature.

Lawrence A. Tomei, EdD
Executive Director, Center TEIR

Additional information for authors, sponsors, and readers is on the Journal webpage at
http://itdl.org

International Journal of
Instructional Technology & Distance Learning
Vol. 1. No. 12. ISSN 1550-6908

Table of Contents – December 2004

Editorial

Online Education: Innovative & Personal

Brent Muirhead

Guest Editor, December 2004

Distance education has demonstrated remarkable growth in student enrollment in the for-profit higher education institutions. Currently, the University of Phoenix has grown to become the largest private university in the United States with over 227,000 students who take classes online and at one of their 158 campuses. There has been a steady increase in the number of online degree programs and online classes that are being offered at traditional universities. Technology advances have increased student access to library content through e-journals, e-books and databases. Online education is entering a new phase of development that places a greater emphasis on academic quality in degree programs. Contemporary online schools must continually upgrade their technology and curriculum to effectively prepare students for current and future jobs and educational opportunities. Nichols (2001) highlights six imperatives for educators in the 21st Century:

- **Increased capacity and efficiency** - through enabling institutions to cater for the learning of a relatively large number of students at once.
- **Improved effectiveness** - by encouraging deep learning approaches and the adaptation of knowledge to the real world.
- **Easy accessibility** - by removing distance barriers and catering for a variety of learners' prior educational experience, physical abilities, and time commitments /lifestyles.
- **A competitive mindset** - education with the potential to be offered internationally, within industry, and at a distance; providing more choice and convenience for the student.
- **A resource-based emphasis** - enabling more student control over what, where, when and how they study and permitting non-linear learning; and
- **The personal touch** - with more interaction between students and between individual student and tutor, enabling a degree of customisation and the pursuit of individual students' learning goals in addition to the prescribed course learning outcomes (pp.13-14).

The six imperatives stress a wise and visionary use of technology that will create relevant and accessible student resources. Distance educators and instructional course designers must continue to explore creative ways to personalize and intellectually enrich the cyber environment. Educational leaders must be willing to make financial investments into technology enhancements and teacher training and professional development. The organizations who are hesitant to make prudent long term financial commitments to online education will risk undermining their academic credibility. Poor financial planning and questionable marketing strategies has already produced several major business failures.

The online university known as United Kingdom e-University (UKeU) collaborated with the British government and invested 62 million pounds ($113 million) to develop their commercial venture. The project began in 2000 and collapsed in 2004 (Garett, 2004). Hopefully, educational organizations will be impatient with the status quo and strive to develop vibrant and new educational paradigms that take greater advantage of today’s multimedia resources.

References

Garrett, R. (2004). The real story behind the failure of U.K. eUniversity. *Educause Quarterly*, 27(4). Available: http://www.educause.edu/apps/eq/eqm04/eqm0440.asp?bhcp=1

Nichols, M. (2001). *Teaching for Learning.* New Zealand: Traininc.co.nz

Editor's Note: Research studies are needed that investigate the quality of discussions in distance education colleges and universities. Today's online instructors use discussion forums as a vital tool to meet course learning objectives, promote student collaboration on assignments and to enhance individual critical thinking skills. The authors have provided valuable insights into online dialogs that will be helpful to instructors and individuals involved in training and mentoring activities.

Assessing Discussion Forum Participation: In Search of Quality

Stephen Corich, Kinshuk, and Lynn.M.Hunt

Abstract

The flexibility that e-learning offers and the growing maturity of e-learning management systems has lead to a rapid growth in the acceptance of e-learning as a method of delivering educational and vocational training. The use of computer-mediated communication (CMC) tools, and in particular asynchronous discussion forums, as a means of promoting communication and a collaboration between e-learning participants has lead to a growing interest by the academic and training community in the pedagogical value of such tools.

This paper looks at the role of asynchronous discussion forums in e-learning and attempts to address the issue of the quality of interaction of discussion forum participants. A number of measurement models are investigated and two of them are used to assess the quality of forum contribution for students participating in a first year undergraduate degree course. The paper concludes by attempting to identify areas where the models could be improved and discusses areas for future study.

The paper will be of interest to those who are involved in delivering e-learning courses and who would like to use discussion forums as a possible assessment tool. It would also be of value to learners who choose to enroll in distance learning courses and who are asked to participate in assessed discussion forum debate.

Key words: e-learning, collaboration, discussion forums, content analysis, cognitive communication.

Introduction

Online discussion forums are now regularly used as a component of distance education courses in tertiary education as a means of promoting interaction between course participants (Spatariu, Hartley & Bendixen, 2004). Discussion forums create an environment similar to the face-to-face classroom environment where knowledge can be critically constructed, validated and shared (Knauka & Anderson, 1998). As the use of discussion forums has grown, an increasing number of researchers have attempted to produce models that measure and analyse the networked conversations produced (Campos, 2004).

This paper presents the results of using two popular discourse analysis methods for evaluating higher order learning and knowledge building in an assessed discussion forum. The forum was used as a teaching tool in a traditionally presented course that was conducted as part of a first year undergraduate computing programme.

The paper looks briefly at the growth in the use of discussion forums in the academic environment and refers to literature supporting the use of computer mediated communication

(CMC). The paper then investigates a number of models used to measure activity within discussion forums. Two of the models are then the focus of extensive scrutiny. The first is based on the model proposed by Henri (1992) and modified by Hara, Bonk & Angeli (2000). The second model was developed by Garrison, Anderson and Archer (2001). These two models were then used to analyse the activity of a discussion forum. The results are presented and discussed and finally recommendations are made on how the models could be modified to better measure levels of critical thinking in an assessed discussion forum environment.

Background

The increasing popularity of the Internet and its ability to provide seemingly transparent communication between different computing platforms has simplified the processes of providing learning opportunities to remotely located learners. The rapid expansion in the use of distance education in the postsecondary education setting is well documented (Spatariu, Hartley & Bendixen, 2004; Green, 2000). The growing maturity of learning management systems (LMS) and the increased sophistication of the communication tools within these systems have lead to an awareness of the ability to duplicate many of the teaching practices available in face-to-face delivery by the academic and vocational training practitioners (Kang, 1988; Rice, 1989).

Computer–mediated communication (CMC) is now used by almost everyone in distance education training (Garrison, 2000) and comprises various forms of electronic communication including synchronous chat, audio and video and asynchronous conferencing, email, and file exchange.

Support for the use of discussion forums in distance education is widespread. Discussion forums are said to allow students to see different perspectives which can help to foster new meaning construction (Heller & Kearsley, 1996; Ruberg et al., 1996). Discussion forums encourage student ownership of learning and collaborative problem-solving skills (Becker, 1992). They encourage participants to put their thoughts into writing in a way that others can understand, promoting self-reflective dialogue and dialogue with others (Valacich, Dennis, & Connolly, 1994). Discussion forums have the potential to expose students to a broader range of views than face-to-face talk, and hence enable them to develop more complex perspectives on a topic (Prain and Lyons, 2000).

A number of different approaches have been attempted to identify quality in online discussions. Spatariu, Hartley & Bendixen (2004), having reviewed current literature, suggest that the majority of studies can be loosely categorized into one of four categories, according to the construct being measured: levels of disagreement; argument structure analysis; interaction-based; and content analysis.

Studies belonging to the level of disagreement category adopt the approach of coding messages according to the level of disagreement that is exhibited in relation to previous posting. Researchers to use this method include Marttunen (1998) and Nussbaum, Hartley, Sinatra, Reynolds & Bendixen (2002). Marttunen (1998) looked at the relationship between personality variables such as anxiety and extraversion in email messages. Nussbaum et al. (2002) adopted a similar approach when looking at students' postings to an online discussion forum. The coding scheme used by both studies was based upon observed willingness of students to disagree with their peers.

The argument structure analysis category codes messages according to the argument quality demonstrated by participants. Researchers that have adopted this approach include Inch & Warnick (2002) and Veerman, Andriessen & Kanselaar (1999). Inch and Warnick (2002) coded arguments into four categories according to the degree of complexity in the argument structure

while Veerman et al. (1999) used a combination of argument and content analysis, classifying messages in terms of information exchange.

Interaction-based coding methods place an emphasis on the message as part of a larger discussion. Schaeffer, McGady, Bhargava & Engel (2002), Järvelä & Häkkinen (2002) and Nurmela, Lehtinen & Palonen (1999) have adopted this approach. Schaeffer et al. (2002) developed five exchange categories and coded postings according to level of relatedness and agreement. Järvelä and Häkkinen (2002) used two different classifications of messages to analyse multiple perspectives. Nurmela et al. (1999) used a three dimensional social network analysis to study the structure of documents and the connections between them.

The content analysis approach codes messages according to the message type. A review of literature suggests that content analysis is the most popular approach used by researchers to evaluate quality in discussion forum postings. The more commonly cited researchers include Henri (1991), Gunawardena, Lowe & Anderson (1998), Newman, Webb & Cochrane (1995), Garrison, Anderson & Archer (2000) and Hara, Bonk & Angeli (2000). Henri (1992) developed an analytical model that highlights five dimensions of the learning process that can be found in messages. Gunawardena et al. (1997) introduced a model of analysis to assess the social construction of knowledge and collaborative learning. Newman et al. (1995) developed an analytical method for the study of critical thinking, which presented a list of indicators of critical thinking. Hara et al. (2002) used a content analysis approach, based largely on Henri's (1992) cognitive and metacognitive dimensions, to support the investigation of quality online discussions. Garrison et al. (2000) assessed inquiry capabilities as well as critical thinking through three dimensional model which measured cognitive presence, teaching presence, and social presence.

A review of current literature indicates that the methodologies adopted by Henri (1991) and Garrison, Anderson & Archer (2000) are two of the most popular content analysis approaches. These two methodologies have been either duplicated or incorporated into models developed by other researchers.

Henri (1991) identified following five dimensions which can be used to evaluate CMC: participative, social, interactive, cognitive and metacognitive. The cognitive and metacognitive dimensions measured reasoning, critical thought and self-awareness and as such are more likely to be of interest when attempting to reward participants for assessed discussion forum contribution. The coding system used by Henri was not clearly defined in her research, but it was used as the basis of subsequent research conducted by Hara, Bonk & Angeli (2000). The cognitive and metacognitive components of the Hara, Bonk & Angeli analysis framework were well defined and they were chosen for this research.

Garrison et al. (2000) developed a 'community of learning' model which assumes that learning occurs through the interaction of three core components: cognitive presence, teaching presence, and social presence. Cognitive presence is defined by Garrison et al. (2000) as "the extent to which the participants in any particular configuration of a community are able to construct meaning through sustained communication". Social presence deals with all those declarations of the students or tutors where the creation of a dynamic group is promoted, including social relationships, expressions of emotions, and affirmation messages. Teaching presence considers the interactions of teachers and students, as they formulate questions, expose ideas and answer questions. The cognitive presence concept was expanded by Garrison ,Anderson, & Archer (2001) into a four stage cognitive-processing model, which was used to assess critical thinking skills in on-line discussions. The model classified student responses into triggering, exploration, integration and resolution categories. The framework for the model was well documented and it was chosen as the second model for the research.

Methodology

The research in this study is ethnographic due to its small sample size and lack of statistical testing. It was designed as a preliminary exercise to a larger research project that will use a larger sample across a variety of institutes, utilizing intelligent software to perform the content analysis coding. The research was conducted to allow the researcher to become familiar with two of the most popular quantitative content analysis models and to attempt to identify if the models could be applied to determine the level of critical thinking for individual students. The research also aims to investigate the attitudes of students in using online discussions as an assessment tool in an environment which combines online learning elements with face-to-face learning elements. Such environments are commonly referred to as blended learning environments.

The transcripts for the discussion forum were compiled into a single document and the document was surveyed in an attempt to identify what to use for a unit of analysis. Having established how the majority of postings were structured and following the advice of Campos (2004), it was decided to use the sentence as the human cognitive unit of analysis. The compiled document was then split into sentences which were then hand-coded against the two models by the course instructor and another instructor who had delivered the course on a previous occasion.

At the completion of the discussion in the forum, access statistics were generated by Blackboard learning management system and students were interviewed to establish their reactions to the exercise.

The Course

The research was conducted during the second semester of a first year undergraduate degree course. All the students were enrolled in a computing systems degree and as such were familiar with using information technology. The course was an introductory data communications and networking class that was delivered using a blended learning environment, combining traditional face-to-face activities with web publishing, on-line review and discussion forum activities. On-line activity, which included publishing the results of a research project, evaluating the work of peers and participation in a discussion forum formed a significant part of the course. The use of the discussion forum was seen as a way to encourage participation as well as to provide a tool to promote discussion over a period of time to a topic that was a key component of the course curriculum. Previous offerings of the course did cover the same topic, the future of data communications, in a normal classroom setting, using face-to-face discussion over a period of at most two hours. Using the discussion forum approach, students were allowed three weeks to participate in on-line discussion.

The software used to support the discussion forum was an integral part of the Blackboard learning management system. All students had previously used Blackboard to retrieve course materials and to participate in on-line tests in their earlier courses; however none of the students had participated in discussion forums during their previous academic study.

The class consisted of fifteen students, three females and twelve males, aged between 18 and 38, and of varying academic abilities. Students were given the topic for the discussion early in the course and instructions were provided to the students as to what was expected in the discussion forum. The instructions were given as a guide to encourage higher level critical thinking. The student postings were monitored by an instructor who provided encouragement, added pedagogical comments and provided reinforcement and expert advice.

Findings and analysis

During the three weeks that the discussion forum was operational a total of 104 posts were made, 30 of which were made by the course instructor. Once the instructor postings were removed, the remaining 74 posts generated 484 sentences for coding.

Participation in the forum varied with almost 35% of postings being made by the three female class members. The six class members over the age of twenty five accounted for 63% of postings. In the under twenty five age group, one class member took no part in the discussion forum activities and the Blackboard software indicated no activity in the discussion forum area, while another who made no postings, obviously read postings as Blackboard indicated significant activity in the forum area. Two under twenty five year olds, made only a single posting, however monitoring software indicated significant activity for both.

Before coding the entire transcript, both instructors looked at the first 100 sentences from the transcript and agreed on how the sentences should be coded against the two models. Once the entire transcript had been coded, the results of the transcript analysis for the two instructors were evaluated to establish the level of agreement that existed, using a coefficient of reliability developed by Holsti (1969). The coefficient indicates a percentage agreement measure calculated by totaling the number of agreements between coders divided by the total number of coding decisions. The coefficient of agreement was 87% using the Garrison et al. model and 81% using the Hara et al. model. Once the coding was completed, tables were produced showing the average score for the two coders for each category of the two models.

Table 1 and table 2 present the summary information on how the 484 sentences were classified for Garrison et al. and Hara et al. respectively.

Table 1:

Number of postings using Garrison et al. (2001, pp. 15-16)

Category	Indicators	Number of Sentences	Percent of Total Sentences
1. Triggering	Recognizing the problem Sense of puzzlement	73	15.08%
2. Exploration	Divergence within online community Divergence within single message Information exchange Suggestions for consideration Brainstorming Leaps to conclusions	124	25.62%
3. Integration	Convergence among group members Convergence within a single message Connecting ideas, synthesis Creating solutions	209	43.18%
4. Solution	Vicarious application to real world Testing solutions Defending solutions	58	11.98%
Not categorised		20	4.13%
Total number of postings		484	100.00%

Coders found the Garrison et al. model the easier of the two models to code, with a higher coefficient of agreement and a lower number of uncategorised sentences. The model indicated a small number of triggering questions, since students were encouraged to discuss and build on the

ideas of others. More than 68% of the contributions were in the exploration and integration area, which probably reflects the fact that this was a first year undergraduate course. Fewer than 10% of sentences were classified in the solution area, and most of the contributions in this area were from a mature student who had recent industry experience in the topic subject.

Table 2:

Number of postings using Hara et al. (2000)

Reasoning Skills	Indicators	Number of Sentences	Percent of Total Sentences
Elementary clarification	Identifying relevant elements Reformulating the problem Asking a relevant question Identifying previously stated hypotheses Simply describing the subject matter	63	13.02%
In-depth clarification	Defining the terms Identifying assumptions Establishing referential criteria Seeking out specialized information Summarizing	121	25.00%
Inferencing	Drawing conclusions Making generalizations Formulating a proposition which proceeds from previous statements	145	29.96%
Judgment	Judging the relevance of solutions Making value judgments Judging inferences "I agree, disagree,,,,"	63	13.02%
Application of strategies	Making decisions, statements, appreciations, evaluations and criticisms Sizing up	53	10.95%
Not categorized		39	8.06%
Total number of postings		484	100.00%

The Hara et al. model was harder to code having five categories compared to the Garrison et al. model with four. The coefficient of agreement was lower and the number of uncategorised sentences was higher. The model indicates that the majority of responses to the forum (54.96%) were in the clarification and inferencing categories, indicative of students responding and building on ideas identified by others.

It was interesting to note that both models indicated similar levels of evidence of knowledge construction and similarly low levels of synthesis and real world application. Both models reflected the preference of students to build and expand on ideas suggested by others.

Even though the research was conducted using first year undergraduate students, the results indicate reasonable levels of knowledge construction and evidence of critical thinking that are comparable to research involving graduate students conducted by Meyer (2004). This higher than expected level of cognitive ability displayed appeared to be as a consequence of the exceptional quality of the first posting, which set the tone for the remainder of the discussion.

When questioned about the experience of using discussion forums as a way of discussing topics which are relevant to the course prescription thirteen of the fifteen students stated that they believed that it was a worthwhile exercise. Several indicated that the process was very time consuming but also said that the three week period gave them time to think about the topic and conduct research to assist with the postings. Students also stated that they found the discussion forum to be "addictive", creating a desire to continually check to see if their postings had induced a response from the instructor or their fellow students. All those who participated in the exercise suggested that they had increased their knowledge as a result of the exercise and would be happy to participate in a similar exercise in the future.

Results and Recommendations

The research indicates that both models provided a useful tool for measuring the quality of student participation within an online discussion forum. Both gave a measure of the level of critical thinking and knowledge construction. When applied to contribution from individual students, again both models were able to distinguish between those who were contributing at higher levels and those who displayed little evidence of critical thinking.

Attempting to evaluate the relative merits of each model was not really part of this research, and the fact that both models indicated similar patterns of critical thinking would suggest that both have their places in the field of discourse analysis. The coding exercise for both models was time consuming and the coefficients of agreement between coders would suggest that the classification of messages is open to individual interpretation. If the models were to be applied to a larger population with a significantly larger number of postings, then some form of automatic coding system would need to be considered. Such a tool would need to be efficient, reliable, valid and practical.

While the use of content analysis as a mechanism for measuring quality was shown to have merits, neither of the models tested gave any indication of how the critical thinking had been applied to the subject domain that the forum was discussing. As such, the models as they have been presented would require modification to be used as a tool to grade student performance in an assessed discussion forum relating to a particular subject domain area.

Student reaction to using discussions forums as a component within the traditional face-to-face teaching environment would suggest that for students who are familiar with technology, the exercise could enhance the learning process. The evidence of this research would also suggest that the discussion forum mechanism better suits relatively mature learners who have desire to learn and take responsibility for knowledge construction. Discussion forums may also disadvantage students who have poor written communication skills and students who may be participating in a forum where the language used is not their first language.

There are several areas that were not investigated as part of this research which have been identified as being worthy of further investigation. These include the impact that familiarity with technology has in the use of discussion forums; the role of assessment in the use of discussion forums; the impact of the instructor in leading or encouraging discussion; the use of triggers to promote discussion and the use of students in moderating discussion content. Others areas worthy of study are the impact on learning of those who read but do not post, commonly referred to as "ropers" or "lurkers"; the impact of negative or zero responses to first postings; and the effect of time on the quantity and quality of responses as a forum progresses.

References

Becker, H. (1992). A model for improving the performance of integrated learning systems: Mixed individualized/group/whole class lessons, cooperative learning, and organizing time for teacher-led remediation of small groups. *Educational Technology 32,* 6-15.

Campos, M. (2004, April). A Constructivist method for the analysis of networked cognitive communication and the assessment of collaborative learning and knowledge building. *Journal of American Learning Networks*, *8(2)*,1-29.

Garrison, D.R. (2000). Theoretical challenges for distance education in the tenty-first century: A shift from structural to translational issues. *International Review of research and Open and Distance Learning,* 1(1). Avaialable: http://www.icap.org/iuicode?149.1.1.2

Garrison, D.R., Anderson, T., & Archer, W. (2000). Critical thinking in a text-based environment. Computer Conferencing in higher education. *Internet in Higher Education*, *2(2)*, 87-105.

Garrison, D. R., Anderson, T., and Archer, W. (2001). Critical Thinking, Cognitive Presence, and Computer Conferencing in Distance Education. *The American Journal of Distance Education 15(1)*, 7–23.

Green, J. (2000). The online education bubble. *The American Prospect,* 11(22), 32-35.

Gunawardena, C.N., Lowe, C.A., & Anderson, T. (1997). Analysis of a Global Online Debate and the Develoment of an Interaction Analysis Model for Examining Social Construction of Knowledge in Computer Conferencing. *Journal of Educational Computing Research,* 17(4), 397–431.

Hara, N., Bonk, C. J., & Angeli, C. (2002). Content analysis of online discussion in an applied educational psychology course. *Instructional Science, 28*, 115-152.

Heller, H., & Kearsley, G. (1996). Using a computer BBS for graduate education: Issues and outcomes. In Z. Berge & M. Collins (Ed.), *Computer-mediated communication and the online classroom.* (Vol. III: Distance learning, pp. 129-137). NJ: Hamptom Press.

Henri, F. (1992). Computer conferencing and content analysis. In A. R. Kaye (Ed.), *Collaborative learning through computer conferencing: The Najaden Papers* (pp. 116-136). Berlin: Springer-Verlag.

Hosti, O. (1996). *Content analysis for social sciences and humanities*. Don Mills, ON: Addison Wesley.

Inch, E. S., & Warnick, B. (2002). *Critical thinking and communication.* Boston: Allyn & Bacon.

Järvelä, S., & Häkkinen, P. (2002). The levels of Web-based discussions—Using perspective-taking theory as an analysis tool. In H. Van Oostendorp (Ed.), *Cognition in a digital world* (pp. 77-95). Mahwah, NJ: Erlbaum.

Kang, I. (1998). The use of computer-mediated communication: Electronic collaboration and interactivity. In C.J.Bonk, & K.S.King (Eds.), *Electronic collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse* (pp. 315-337). Mahwah, NJ:Erlbraum.

Knuka, K. & Anderson, T. (1998). Online social interchange, discord, and knowledge construction. *Journal of Distance Education*, *13(11)*, 57-74.

Marttunen, M. (1998). Electronic mail as a forum for argumentative interaction in higher education studies. *Journal of Educational Computing Research, 18*, 387-405.

Meyer, K.A. (2004, April). Evaluating online discussions: four different frames of analysis. *Journal of American Learning Networks*, *8(2)*,101-114.

Newman, G., Webb, B., & Cochrane, C. (1995). A content analysis method to measure critical thinking in face-to-face computer supported group learning. *Interpersonal Computing and Technology*, *3(2)*, 56-77.

Nurmela, K., Lehtinen, E., & Palonen, T. (1999). Evaluating CSCL log files by social network analysis. In C. Hoadly & J. Roschelle (Eds.), *Proceedings of the Third Conference on Computer Supported Collaborative Learning* (pp. 443-444). Stanford, CA: Stanford University.

Nussbaum, E. M., Hartley, K., Sinatra, G. M., Reynolds, R. E., & Bendixen, L. (2002, April). *Enhancing the quality of on- line discussions*. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

Palloff, R. M., & Pratt, K. (2001). *Lessons from the cyberspace classroom: The realities of online teaching.* San Francisco: Jossey Bass.

Prain, V. & Lyons, L. (2000) Using information and communication technologies in English: An Australian perspective. In A. Goodwyn (ed.). *English in the Digital Age*. London : Cassell Education.

Rice, R.E. (1989). Issues and concepts in research on computer-mediated communication systems. In J. Anderson (Ed.), *Communication Yearbook, 12,* 436-476). Beverly Hills, CA: Sage Publications.

Ruberg, L., Moore, D., & Taylor, D. (1996). Student participation, interaction, and regulation in a computer-mediated communication environment: A qualitative study. *Journal of Educational Computing Research*, 14(3), pp. 243-268.

Schaeffer, E. L., McGrady, J. A., Bhargava, T., & Engel, C. (2002, April). *Online debate to encourage peer interactions in the large lecture setting: Coding and analysis of forum activity*. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

Spatariu, A., Hartley, K. & Bendixen, L.D. (2004, Spring) Defining and Measuring Quality in On-line Discussion. *Journal of Interactive Online Learning. Vol 2(4).*

Valacich, J., Dennis, A., & Connolly, T. (1994, March). Idea generation in computerbased groups: A new ending to an old story. *Organizational Behavior and Human Decision Processes*, 57, 448-467.

Veerman, A. L., Andriessen, J. E. B., & Kanselaar, G. (1999). Collaborative learning through computer- mediated argumentation. In C. Hoadly & J. Roschelle (Eds.), *Proceedings of the third conference on Computer Supported Collaborative Learning* (pp. 640-650). Stanford, CA: Stanford University.

Steve Corich

Steve Corich is Principal Lecturer of Information Technology at the Eastern Institute of Technology, Hawkes Bay, New Zealand. He is currently pursuing PhD in the area of models of assessment in asynchronous interaction environments.

Kinshuk

Kinshuk is Director of Advanced Learning Technology Research Centre and Associate Professor of Information Systems Department at the Massey University, New Zealand. He has published over 130 research papers in international refereed journals, conferences and book chapters. He is currently chairing IEEE Technical Committee on Learning Technology, and the International Forum of Educational Technology & Society. He is also editor of the SSCI indexed Journal of Educational Technology & Society (ISSN 1436-4522).

Lynn Hunt

Lynn Hunt is Senior Lecturer at Massey University, New Zealand. She has a PhD in learning psychology. She is working and researching in area of e-learning since 1984. She was the Director of the project PC-120 to upgrade the government owned flight training school (Curug) in Indonesia, the largest curriculum design and development project ever undertaken by Massey University.

Editor's Note: Tao (Helen) Hou provides informative insights into the developmental plans and challenges of distance education in China. It is an exciting time in China as they create a distance education system that will effectively meet their higher education learning needs.

OPEN Public Commonwealth Support System of Distance Education (PCSSODE)

A Practice of Supplement Quality Assurance System of E-Education in China

Hou, Tao

Since Renmin University of China, Hunan University, Beijing University of Telecommunication and Zhejang University, launched pilot projects of online degree education programs approved by China Ministry of Education (MOE) firstly in 1999, the tide of e-learning had swept China. By the end of 2003, 68 universities have received approvals for supplying online degree education programs from MOE, and over one million students spread in 2700 learning centers in China had being pursuing their bachelor degrees or college diplomas by distance education in China (data from MOE)

With the internet bubbles broke up, the fever of online education cooled down. The universities offering online program began to rationally retrospect their practices at online education. They find that their professors who used to teach in class rooms are bewildered with virtual students, new teaching methodology and internet behavior as well as the traditional learning culture challenges. The on line courses aren't accessible in less developed areas because most online courses have used large digitalized video. The online materials are boring because most of them are just typed from textbook and they lack any teaching design. The shortage of interaction between students and professors which can help solve the learning problems promptly, keep students motivation or even merely maintain group learning atmosphere for oriental students, has greatly impacted the student's examination results and education quality (Zhang Weijian, 2001). Meanwhile, with less distance education management experience, the universities are frustrated to handle kinds of education administration affairs at local learning center thousands miles away at the social environment of lacking popular reliable online banking service and credible examination services. Also, a growing number of the student complaints involving poor services raised here and there, have placed great pressure on the MOE or local governments. The answers of following question are exigent and crucial for the further development of online education.

How to deliver multi-media courses and materials to every student in time especially in the less development areas with poor internet accesses which usually have big distance education markets?

How to supply professional student support and educational administrations services at present technical and culture environment in far away learning center to assure the education quality?

Concept of PCSSODE

The idea of establishing a public commonwealth support system of e-education (PCSSODE) as the systematic solution of common problems faced Chinese online-education is proposed by China Central Radio and TV University (CCRTVU). The public means that all the services of PCSSODE are available for various distance education program provider. The distance learning center of PCSSODE would open to all students registered in various universities who would pay

PSSODE for high quality local student services and management services. The main services supplied by PSSODE are:

High quality e-learning facility at local e-learning center including computers, high speed internet access, satellites receiver, experienced educational management staff team and other convenient service facilities.

Learning recourse and information transform services using combined Satellite and internet techniques and web-base education platform.

Standard management service at local learning center including consulting, registration, technical support, tutors guidance of public course, book ordering and examination service as complement of quality assurance system of distance learning.

Institutions of OPEN PCSSODE

The Ministry of Education of China approved the pilot project of public commonwealth support system of distance education based on China Radio and TV University (CRTVU) system at the end of 2001. CCRTVU and CRTVE-Online, of which CCRTVU own 50% share, constituted OPEN Distance Education Center to execute the pilot project in Oct. 2002.

The OPCSSODE is franchise system which consists of three tiers of organizations (Fig. 1)

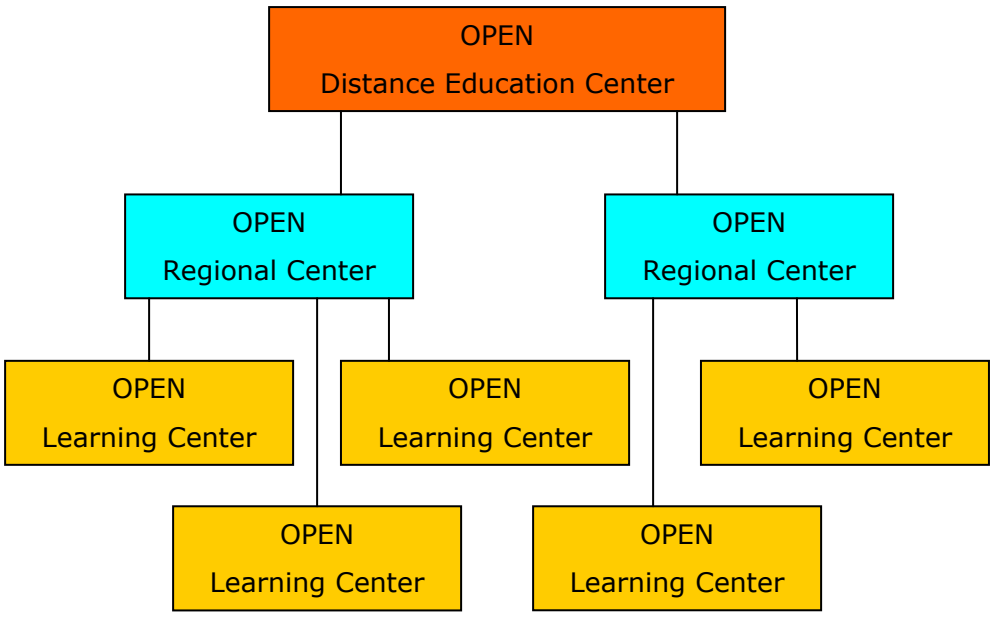


Fig. 1. OPEN PCSSODE – three tiers of organization

The OPEN Distance Education Center is the center and soul of the OPEN PCSSODE. It authorizes the schools that pass the assessment of OPEN the right to use brand of OPEN to supply distance education services according to Open's criterion and standard. It supply technical support and training to RCs and LCs. OPEN signs the contract with e-University who would cooperate with OPCSSODE and in charge of the satellite broadcast services and running of education platform.

The OPEN Regional Center of Distance Education (RC) play the important role of hub that joins the OPEN Distance Learning Center and learning center. It follows out the instruction of OPEN Distance Education and carries out the support work to regional learning centers and is responsible for the legal affairs and public relationships with local governments.

OPEN Public Learning Center of Distance Education (LC) is the element of the OPEN PCSSODE. It equipped with excellent facilities that supply local face to face support and group work environment for local students. Students can enjoy various services of registration, technical support, book ordering and collection, tutor guidance of public courses, examination service and even psychology consulting at nearest local center. The learning center also support e-Universities and OPEN Distance Learning Center get feedback of students and do other management job.

OPEN Distance Learning Center aimed at setting up a franchise system with 1000 standard public distance learning centers covering 31 provinces in 5 years. 44 provincial Radio and TV Universities, their 752 city branches and some other adults schools have been motivating to participate the project. By the end of Oct. 2004, 270 schools with eligible facilities and experienced tutor teams are assessed and granted to join the PCSSODE by OPEN Distance Education Center. 87 OPEN LCs are running, about 15000 students of 13 Universities of Zhejiang University , Xi'an Jiao tong University, Beijing University of Aeronautics and Astronautics, Beijing Jiao ong University, Shandong University, University of Petroleum, China University of Science and Technology, Northeast University of Finance, Northeast Teaching University, Central University of Music Dalian University of Science and Technology, Northeast University of Agriculture are enjoying the services of PCSSODE.

The technical mode of OPEN PCSSODE

The operating of OPEN PCSSODE is based on combination of internet and satellite communication technology. Using Satellite transmission techniques benefits the students in less developed areas to help them access the video and stream media courseware easier locally. The online courses in various formats on a learning platform are packed and upload by the center of OPEN PCSSODE to the digital IP broadcast server of China Education TV station (CETV) and broadcasted to the local VAST station at learning center through Satellite Asia II IP channel. After unpacking, the content will be released on either the education platform installed on the LAN or TV in learning center (Fig 2). The students could browse the information stored at LAN at their convenience at learning center. Individuals could also receive the broadcasting through Cable TV at home by installing a special top-TV box while others who have board band internet access can use the internet to do the same work. The ceremonies of term beginning are broadcast live at every term when freshmen start. Live classes broadcast both through satellite and internets are available according to the feedback of students and teaching plan.

Interaction of teacher and student are realized on the web-base online platform through the internet. Every learning center has wide band port access to the internet. The platform of the OPEN Education Management System (OEMS) support function of real time class chat room, class forum, BBS, self-assessment that encourages students to enjoy their studies. This is very crucial for the student in the less development areas who are without enough eligible tutors to give them face to face assistant classes. Besides virtual support, students are encouraged to communicate with their classmates and to collaborate on assignments at times in face to face meetings at learning centers.

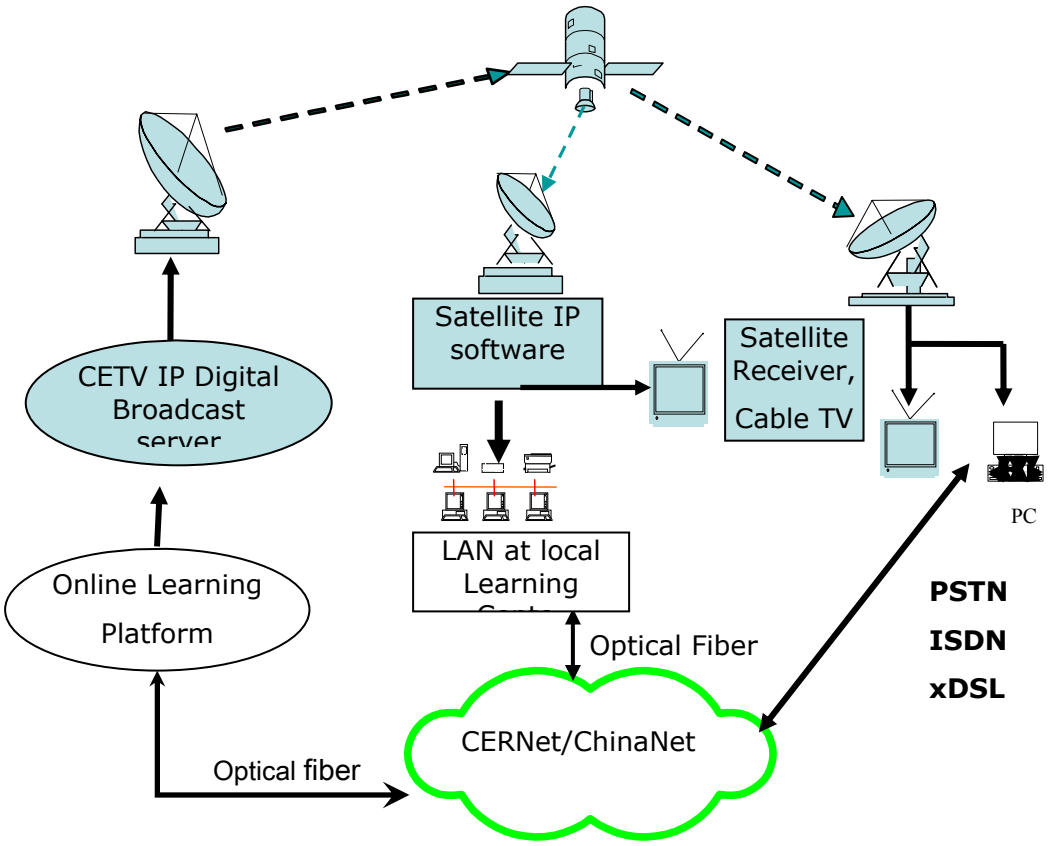


Fig. 2. Combination of Internet and Satellite Technologies

The digital satellite broadcast are being efficiently used now at OPEN PCSSODE, however the cable pass is not optimistic option because of high financial charges of the cable suppliers. The realization of the Satellite VOD potential will require more work to save storage room at there local servers.

Summary

With the rapid grows of online education in China, the student support and education management of distance learning center have faced big challenges. OPEN Public Commonwealth Support System of Distance Learning (PCSSODE) aims at supplying distance education provider and student professional services as a way to supplement the quality assurance system by setting up a franchise system based on CRTVU system employing satellite transmission and web technology. The ongoing pilot project reached milestone of service 15000 students and 13 Universities by now. The idea of OPEN PCSSODE has potential educational benefits but will need time to verify.

References:

Approval of pilot project of Constituting Public Support System of Distance Learning based on CRTVU system. Letter 268 of Higher Department of Ministry of Education of China, Dec. 2001.

Comments of the Ministry of Education Concerning Enhancement the Management of College of Online Learning in Universities and Improvement the Education Quality, Document 8 of MOE, 2002.

Zhang Weijian, Wu Gengsheng, Li Fei, The Executing Condition of China Distance Learning Program, A Survey on Distance Learner , China Education and Research Network, Sept. 2003 http://www.edu.cn/20030912/3090827.shtml

Handbook of OPEN PCSSODE, OPEN, Distance Education Center, V1.0 , 2003.

Li Guobin, The Open Education Platform Based on Internet and CEBSAT, Dissertation of Engineer Master degree of Beijing Polytechnic University June, 2004.

About the Author:

Tao Hou

Tao (Helen) Hou got her MS degree and BS in Engineering Mechanics from Beijing University of Aeronautics and Astronautics. She is Ed. D Candidate in Peking University.

Ms. Hou is Vice President of CRTVU Online Educational Technology Ltd, Associate Director of OPEN Distance Education Center and the member of Distance Learning Expert Group of Beijing Education Committee. She had been a classroom teacher at university for 4 years and has 10 year experiences of management. She is recently engaged in a new MOE project of Alliance Quality Examinations of Four Fundamental Courses on China Online Education Students.

Editor's Note: There have been numerous articles on the value of utilizing constructivism in computer-mediated classes. Yet, the research literature has had a glaring weakness in advocating the constructivism philosophy that has not been adequately examined in online classes. Donna Russell's investigation offers a compelling narrative of the difficulties of translating educational theory into the online instructor's teaching practices.

Paradigm Shift: A Case Study of Innovation in an Educational Setting

Donna L. Russell

Abstract

This paper describes an ethnographic case study of the implementation of an innovation cluster which included the development of an authentic problem-based unit using online technology in a fourth grade classroom in a suburban Midwestern U.S. city. This case study analysis is part of a larger study of an online collaborative program that included four teachers in the design and implementation of a collaboratively implemented problem based unit. The study participants were four eMINTS teachers who implemented an online authentic problem-solving unit, *Improving Interstate 70*, simultaneously in 4th and 5th grades in four different school districts, including urban, rural, suburban and a small city districts, throughout Missouri during the 2001-2002 school year. This paper is concerned with the development of the unit by a suburban fourth grade teacher we call Linda (a pseudonym). The researchers used Activity Theory to systemically analyze the teacher's effort to innovate by reviewing the contextual issues, the collaborative professional development processes and the teacher's concepts of constructivist learning processes as progressive issues that arose during the implementation of the innovation cluster. As a result the researcher was able to define the responses of the teacher that affected the effectiveness of her implementation of an innovation cluster into her classroom.

Research Context

The eMINTS program is a statewide effort to upgrade Missouri's classrooms in the 21st century by combining cutting-edge technology with first-class teaching. EMINT establishes demonstration classrooms in Missouri's public schools to illustrate the use of technology in classroom instruction. School districts, selected by Missouri's Department of Elementary and Secondary Education (DESE) to participate in the program, choose classrooms - typically third- or fourth-grade, which are transformed into models of integrated inquiry-based instruction. The study focused on four eMINTS teachers designing and implementing the authentic problem-based unit titled "Improving Interstate 70". They implemented the unit during a six-week period in April and May of 2002. The study focused on four eMINTS teachers who worked with students in 4th and 5th grades in different schools in Missouri. These four teachers were originally part of a cohort of 45 teachers who were invited to participate in a pilot project at MOREnet (Missouri Research and Education Network) that involved learning about a new online tool, Shadow NetWorkspace™ (SNS) developed by the University of Missouri-Columbia College of Education.

The teacher that is the focus of this paper teaches 4th grade in one of 13 elementary schools in a suburban community (population in 2000, 112,803) with an enrollment of 610 students. The 48 certified staff serves students in grade PreK-6. Linda, who has taught 4th grade for 10 years,

works with 22 students, all of Caucasian ethnicity including 12 boys and 10 girls. As a part of her participation in the eMINTS program for three years, Linda has 12 Pentium3 LCD computers, one teacher workstation, a Smartboard, a scanner, a color printer, and a digital camera.

The Innovation Cluster

Rogers (1995) suggests that some innovations, usually technology innovations, are better viewed as a cluster, in which the innovations within the cluster share a complementary relationship. An innovation cluster in this study is defined as the implementation of more than one innovative tool in order to develop change. The two innovations implemented by the teachers included 1) Shadow NetWorkspace™ (SNS), and 2) a unit design framework, "*Improving Interstate 70*", based on constructivist learning principles developed through authentic problem-based units. Given Roger's definition of an innovation cluster, it seems reasonable to consider SNS and the unit design as an interconnected innovation cluster since elements of the unit design framework and elements of SNS can be seen as interrelated and interdependent based on their purposeful implementation in Linda's classroom to develop advanced problem-solving abilities in her students.

Shadow NetWorkspace™

The teachers in this study used SNS to collaborately design and implement the unit. Their students also collaborated online throughout the unit and interacted with experts in related domains using SNS. SNS (Laffey, Musser, & Espinosa, 2000), designed and produced by the Center for Technology Innovations in Education (CITE) at the University of Missouri at Columbia, is a web-based work environment designed and developed specifically for use in K-12 schools to support schools and learning. Shadow was developed at CTIE with support provided by the SBC Foundation, the Missouri Research and Education Network (MOREnet), the University of Missouri System, and the U.S. Department of Education. The operating system for SNS is Red Hat Linux. Since SNS is distributed with an open source license, it is free to all schools. MOREnet served the middleware tool from its server to the schools of the participating teachers.

Design Framework: Improving Interstate 70

The instructional design template was provided to all the teachers and was a structure for the unit but allowed for flexibility in how the teacher conceptualizes the unit as a relationship between her theories of learning and preparation of the unit and clarification of purposes for the instructional process in her classroom. Drawing upon literature in problem solving, specifically design (Jonassen, 2000), the unit engaged students in authentic problem-solving processes. In order to develop advanced problem-solving abilities, students must be actively involved in practices directly related to the problems of a particular domain rather than passively reading about, hearing about, or merely thinking about those practices as something outside of school (Barab & Duffy, 2000; Lave & Wenger, 1991). Prior to the design of the unit, the researchers consulted with project engineers and environmental specialists at the Missouri Department of Transportation in order to conceptualize how experts in the field tackle an ill-structured design problem such as redesigning Interstate 70. As the teacher or more knowledgeable person (i.e., expert in the field) created a supporting structure that can initiate and sustain students' interest, the students become involved. Scaffolding, which occurs through modeling, structuring activity, or coaching (Collins, Brown, & Newman, 1989), provided clarity and created momentum for the students to gradually gain control of the task and take over more of the responsibility (Wertsch, 1998; Bruner, 1984). Consequently, each phase of the unit builds on students' prior knowledge and/or knowledge constructed from the previous phase.

First, in Phase 1, students worked in groups of two or three students to gather and analyze information about the importance of the Interstate 70 problem to their community. Each small

group of students will present their perspective to the other groups in the class, while the teachers facilitates students negotiating multiple perspectives and shared understanding (Resnick et al., 1991). In Phase 2, students formed cross-classroom workgroups based on the areas of expertise they identify as important to solving the Interstate 70 problem. After the four participating classrooms determine the number of areas of expertise to investigate, the teachers divided her students (based on their interest) into the determined number of expert groups. Then, the students, working with students from the other classrooms in the same expert group, will collaborative using network technologies to develop conceptual understanding of the expert area and determine the importance of that expert area to solving the Interstate 70 problem.

In Phase 3, students create collaborative solution groups within their classrooms that consist of students from all of the areas of expertise. The students, who took on various roles in the knowledge building process in Phase 2, will now work with others in a jigsaw format (Aronson et al., 1978) to develop group understanding of each area and of the interdependence of expert areas.

Method

The data collection process uses interpretive research practices to capture the dynamics and complexity of the work activity of the teachers. The research was a collaborative effort between the author and Dr. Arthur Schneiderheinze. We were able to develop a concept of the teachers' responses and beliefs at several data points throughout the study and also able to describe their responses to different types of professional development processes. Using cultural historical Activity Theory (AT) as the framework for analysis, the researchers created structured coding categories based on the AT model and the concept of mediation (Wertsch, 1986) and integrated theoretical constructs from related fields (e.g., professional development, innovation, collaboration) into operationalized groupings of interactions in the local and collaborative work activity of the teachers (Engeström, 1987).

There was an audio-taped semi-structured interview with all the participating teachers prior to the beginning of collaborative professional development. The purpose of this interview was to articulate several AT aspects of the activity, specifically goals/motive and context (rules, community, and division of labor); and to understand the teachers' philosophy of learning and teaching including identifying their previous experiences in instructional design. The format of the interview was informal; however, the pre-structured questions and probes insured that all aspects of the AT model were identified at this data point. (Fraenkel & Wallen, 1996). Some of the questions included:

1. What do you hope students take away from participating in this unit? [goals/motive]
2. Describe a unit that you have done that helped your students develop higher-level thinking skills.
3. Who or what do you believe supports you in the design of instructional units? [community]
4. What benefits have you seen in the use of technology in the classroom? [mediation, goals/motive]
5. How will successfully designing and implementing this unit affect your goals as a teacher? [object]

Prior to initiating the four teachers participated in four 1 hour chatroom conferences in SNS designed for them to share plans for each of the phases, revisit their shared vision for the instructional unit in terms of those plans, and negotiate aspects of the unit that require a coordinated effort. During the last scheduled chat, the teachers themselves decided to continue

chatting weekly and developed a schedule for these dialogs. Subsequently they had four more chats occurring throughout Phase 1 and Phase 2 of the unit.

After the unit we either audio taped a semi-structured interview or the teachers completed an online questionnaire. This interview and questionnaire were designed to be the same as the pre-unit interview. The purpose of this last interview was to develop several aspects of Activity Theory, specifically goals/motive and context (rules, community, and division of labor); and to understand the teachers' philosophy of education and experiences in the instructional design process and to compare these final responses to the initial responses in order to define changes in the teachers' concepts about the constructivist unit. The questions and probes insured that all aspects of AT received attention (Fraenkel & Wallen, 1996; LeCompote & Preissle, 1993; Maykut & Morehouse, 1994). Sample questions, which were based on the model for using activity theory as a framework for understanding components of constructivist learning environments suggested by Jonassen & Rohrer-Murphy (1999) and are asked of all teachers to increase comparability of responses, included:

- What did you hope students would take away from participating in this unit? [goals/motive]
- Who or what do you think affected how you were able to implement the "Improving Interstate 70" unit? [community]
- What benefits or costs have you seen as a result of the implementation of this unit in the use of technology in the classroom? [mediation, goals/motive]
- What aspects of this project do you anticipate using in the future? [object]
- What types of professional development would be beneficial to you in helping you design and implement similar units in the future? [mediation]
- What limitations do you foresee that you would need to consider if you were to implement this unit or a similar unit next year? [rules, community, division of labor]
- In terms of instructional design, would you consider yourself innovative? [subject]

Using Activity Theory as a methodological framework for data analysis each case study provides a detailed description of the teacher's work activity settings using the nodes of AT in order to identify relationships in the data. Conflicts in these relationships, as described by each teacher that occur during implementation of the unit will be identified as contradictions. The responses of the teacher to these contradictions are further identified as a turning point. A turning point is a change in the implementation of the object by the teacher as a result of her response to a conflict between the factors identified in the AT model. A turning point response to a contradiction will further be identified as resolved, the teacher was able to maintain or expand her object by working out the tensions in the system, or unresolved, the teacher did not work out the tensions and the object was narrowed. These turning points will be identified in each teacher's case study analysis and displayed at the conclusion of the analysis.

The theoretical model for the design of this study also emphasizes this understanding of the importance of contextualizing the research process in real-time classroom responses of the teachers to contradictions in their work activity based upon the perceptions of the teachers. This contextual emphasis, reflected in the use of AT as a framework for analysis, is a response to the social nature of human learning, (Wertsch, 1985), and incorporates an emphasis on ecological validity and practical relevance (Anderson and Anderson, 2000). This is a non reductionist process as it requires the consideration of the mediated nature of the participant-object relationship. Additionally the identification of response to contradictions is essential in order to understand human development without dualism and subjectivism (Roth & Tobin,

2002).Therefore, a systemic analysis has two potential benefits, it can aid the researcher in developing an understanding of the activity from the perspective of the agent, and it can potentially create a functional understanding that will correlate to similar contexts.

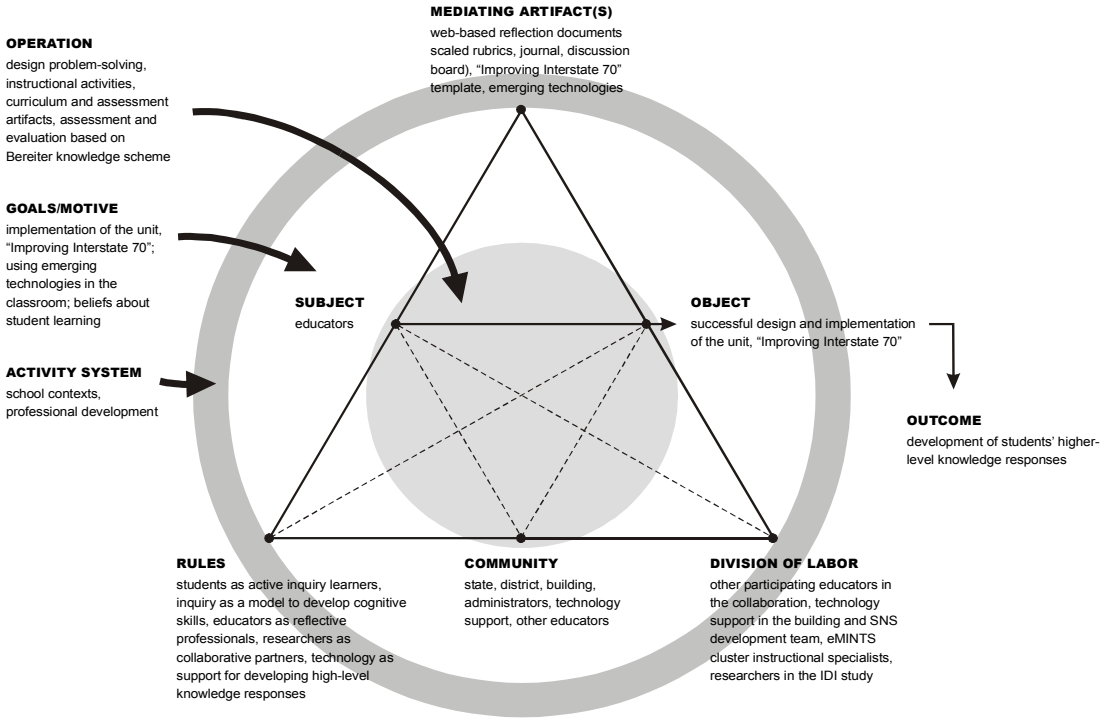


Figure 1: AT Model of Teacher's Work Activity

In order to identify change in the development of the object for each teacher we used the concept of transformation of object. The object of the work activity for each of the four teachers is the implementation of the unit based on the development of constructivist-based learning principles she described as motive for engaging in the activity. Transformation will be identified as a change in the object such as widening, narrowing, switching and disintegrating (Kärkkäinen, 1999). Widening of the object means that the expansion of the object such as completing more of the unit than anticipated. Narrowing of the object means the contraction of the object such as doing less of the unit than anticipated. Switching of the object means a shifting of the object in response to tensions in the system. Disintegration of object indicates the teacher's response to the work activity setting is fragmented in response to the object such as she may fail to implement the unit or use the technology.

Progressive Issues

During the course of data collection and response, we identified three progressive issues that were factors in the teacher's responses to the development of her object.

1) Beliefs about Learning

The philosophical beliefs of the teachers participating in this study is considered motive in relationship to their work activity system. These concepts were identified through pre and post interviews and questionnaires. Motive, in this study, is compared to the concept of outcome and understood through the voice of the teacher's. The teacher's work activity model considers her

motive and the potential outcome. The outcome is the potential result of the work activity and realized by the transformation of the object of the activity. Motive is an overarching goal for implementing the reform unit. This concept can be compared to a goal as something noteworthy that one hopes to achieve. The object has inner dynamics that are manifested in activity and affect the desired outcome. The object is therefore changing during the activity. According to Engeström (1987) expansive learning means the expansion of the object and the motive of the activity including differences in the aim of the activity, what is produced by the activity and why it is produced. Changes in the teacher's beliefs about the purpose for implementation, motive, are used in this study to categorize transformation of the object in regard to outcome and to identify expansive learning responses of the teachers.

2) Collective Activity

Objects and motives of activity are collective. The object of activity is twofold in that is both something given or something projected or anticipated (Leont'ev, 1977). In activity theory, collaborative learning in a group can be analyzed as object formation. Not all collaborative learning is expansive however, since collaborative learning processes contain contradictory and multi-voiced elements qualitatively narrowing the cycle potentially leading to reduction in the activity (Engeström, 1987). We analyzed the collaborative dialogs for dialogic turning points in the individual teacher's dialogs in order to identify turning points in the collaborative professional development and whether the turning points led widening or narrowing of the object.

3) Context Issues

In the AT Model contextual issues are those aspects of community, division of labor or rules that impact the teacher during implementation. These are the aspects of the local context that can potentially be a source of tensions in the system that lead to contradictions that are either resolved or unresolved. Through the identification of contradictions and the teachers' responses to those contradictions, turning points, in their individual work activity system, I was able to identify widening, narrowing or disintegration in the teacher's object formation as a result of each teacher's local environment. If the teacher is unable to resolve the local contradictions that arise during implementation of the unit the result can be a narrowing of the object. This may be demonstrated as a scheduling contradiction, such as departmentalization rules in her building, that the teacher is unable to reconcile with her goals for the unit.

Case Study: Linda

Linda teaches fourth grade in a suburban school. She has taught for 14 years, the last 10 years at this school. Linda, who has taught 4th grade for 10 years, works with 22 students, all Caucasian ethnicity, 12 boys and 10 girls. Linda has participated in the eMINTS program for 3 years. This means she has received approximately 200 hours of training in inquiry learning methods and the use of technology. When she volunteered to participate in the Pioneer's Project she received an additional 18 hours of training over 3 days on the tools in Shadow Net Work Space (SNS).

Before the unit began Linda met with the researchers and discussed her goals for this pilot project. During this pre-unit interview she said that she had done similar units before and was very comfortable with the process of inquiry. She expressed excitement about doing the unit and working with the two researchers. She also expressed an interest in teaching other teachers about SNS after the unit was over. She had presented her participation in the Pioneers Project to the Board of Education in her district. She described herself as working in a highly collaborative and supportive local work environment. She was not familiar with SNS but she was willing to use it during the unit. "I am very intrigued with this Shadow Net work Space (SNS). I have gotten over the fear factor because it was kind of a new unknown adventure and when I see an opportunity is available to do something new and exciting in this program with the kids I take it."

However, when Linda described her previous inquiry units during the pre-unit interview she described units that were either teacher-driven research projects or Web Quest projects. These types of inquiry units did not engage students in authentic complex problem solving and open-ended inquiry processes as designed in the I-70 framework used in the pilot. During the pre-unit interview she was presented with the unit framework and she looked over it briefly. She felt it would be meaningful for the kids. She wanted her students to be able to identify and solve complex problems and she wanted her students to understand that many perspectives were necessary to understand and solve a complex problem. These learning goals were identified as her motive for implementation.

Linda developed several exciting instructional activities that she shared with the participating teachers during the online chats. One project included creating a puzzle that she posted on the front board. It represented all three phases as pieces to a puzzle. As the students moved through the unit they put together the puzzle. At the end of Phase 1 her students created a concept webbing using Inspiration. This activity was suggested by the engineering teacher at the high school. However during Phase 2 Linda's schedule was ahead of others and she was unsure how to develop her Phase 2 student activities. She decided to have her students study some of the case studies posted on the web site. Linda felt that the reading level and the content were difficult for her students and she ultimately moved into Phase 3 without scheduling chats with the other students. During Phase 3 her students presented their solutions to the MODOT personnel. They created a variety of presentation modes including PowerPoint slides, posters and web pages to demonstrate their solutions to the problem of I-70 in Missouri. However, she finished the unit within her own classroom.

Progressive Issue #1: How does the teachers' participation in collaborative professional development influence the implementation of a constructivist-based learning environment?

Linda participated in all 8 chat rooms prior to and during the unit. She initially responded very positively to these synchronous dialogs with the other teachers and the researchers. She was willing to ask productive questions and give examples of her work. Her examples of instructional processes were productive and useful to the collaborative process during the first 6 chats. She aided the professional development process of the other teachers by becoming a source of ideas and encouragement.

Below is a dialog from Chat Number 6 which occurred during Phase 1 of the unit.

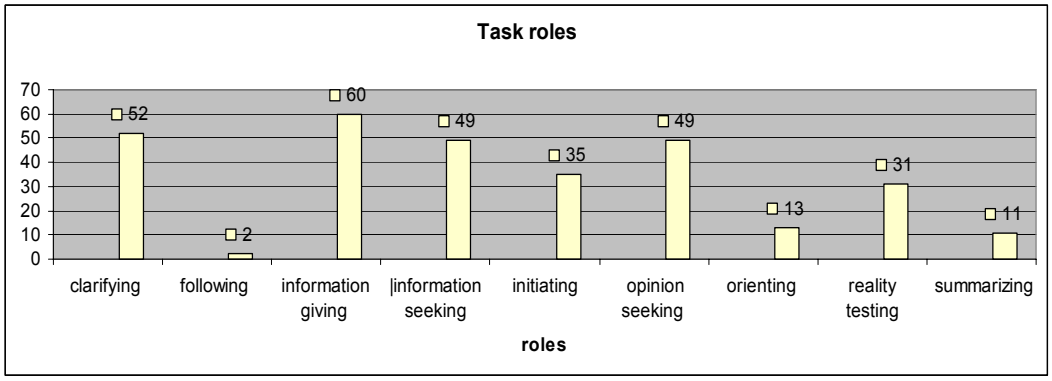
Janice: I would love to see the questions your kids asked their family members.

Linda: It really helped them look at the local picture, which has been hard because they want to fix the problem right now!! :-) By looking at the data they could see the relationship between some of their concerns (like.... too much traffic flow) and actual data that had been gathered. One of the charts we looked at was population and one was traffic flow. Several kids quickly noticed the relationship between how many people live here and the increased problem with traffic flow.

Below is a chart showing her task role change in the collaboration process. She initially developed a positive role response during the chats with the other teachers. She spent much of her time online information giving, clarifying the process, and information or opinion seeking. She was a positive influence in the collaborative process aiding the group in developing their object. The numbers represent total number of task roles instances coded for Linda during all the chats. An instance in this study is a line of text.

Table 1

Task-Roles



Below is an example of an interactive dilemma that occurred during chat # 4. This text was coded as a transformative event for the group, a dialogic turning point. The object, implementing the unit, was changed as the teachers worked out this important issue of how to decide on the number and descriptions of the areas of expertise. These groups had to be the same in Phase 2 so the students could create online groups that included students from each class. During Phase 2 it was very important that the collaboration process work for the teachers in order for the students to be able to work collaboratively online to create expert strategies as part of the solution process. Linda had earlier suggested each teacher load the description of two areas of expertise on the bulletin board as a possible solution to the problem.

Linda: I can also list each expert area with a definition....or would that be inhibiting the inquiry process?

Carol: NO! We need to rename these!!!!!!! Don't decide that yet, Linda.

Helen: I think that is a good idea Linda.

Helen: I think if we get a good description of the job we won't have to rename them

Janice: All eight of the areas listed seem to be the key to an inquiry of i-70.

Linda: I'm O.K.. with 8 as long as we have job descriptions. This is a great time to talk about careers and these titles are really what these people are called.

Janice: I'm okay with them also.

As a result of this interchange, Linda, Janice and Helen all combined to establish the expert groups. Linda initiated a solution and defined it in the chat forum. Her task role in the collaborative dialogs was positive in regard to the completion of the task. She was supportive of the other teachers and presented solutions to their questions sometimes taking on the role of the unit developer in the implementation of the unit itself.

She did, however, begin to express anti-task responses during chats in Phase 2 beginning with Chat number 7. During this time her responses became less positive toward task completion responses. Below is an example of a dialog that occurred during Chat 7 which occurred during Phase 2. The question she posed to the researcher earlier in the chat dealt with the definitions of the experts and the process of the students asking questions that relate to these expert areas.

Researcher: We posted a list of "possible inquiry questions" on our Before the Unit discussion board... in theory, we imagined each set of local experts focusing on

only one question (in total, there would be 4 per expert group since there are four classes).

Carol: I am concerned about the hard text most of those articles have. I barely understand the categories myself!! In fact, when I explained human environment, I was totally wrong according to what we read on Linda's site. My kids are in 7 groups, not all 8. I do not understand how the communicating with the experts will happen.

Linda: I hate to sound so negative about the start of Phase 2, but there is nothing worse than the feeling I had today.....and that was I could not help my kids. I found myself getting grouchy (I know that's hard to believe :-) and it wasn't my kids fault... I just felt like I was winging it (and I told you I do not like that feeling)

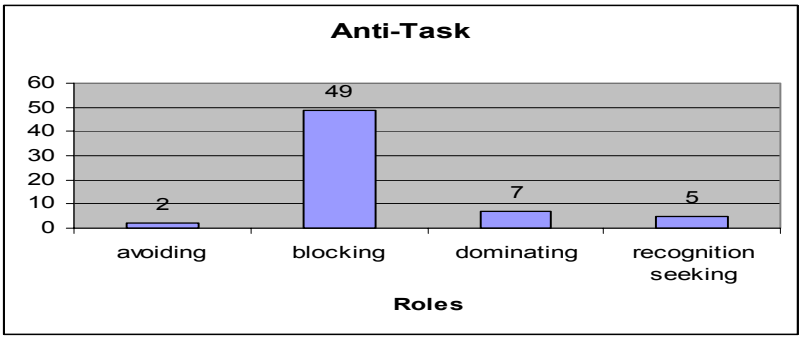
Carol: I totally agree!!!!!!!

Linda: I don't feel like I have given them enough background about their expert area to come up with good questions. Even after discussing each job specifically and talking about what types of questions they might try to answer as an expert in their field.....many of my kids still said "I don't get what my job is?" This was after we discussed them as a class.....

Linda expressed real frustration with the student activities in Phase 2. This frustration was expressed in the chats as anti-task roles. Her responses in the above text were coded as blocking which includes preventing team decision-making through non-support. Her inability to define the activities locally became a blocking point in her interactions with the other teachers. Below is a chart of text instances coded for Linda as anti-task behaviors including avoiding the task, blocking the task, dominating the dialog or recognition seeking. All of these dialogic instances occurred during Chat 7 when Linda was developing the expert areas in Phase 2. She did not implement the online dialogs between her students and the other classes. She responded by moving into Phase 3 without implementing the Phase 2 online activities. Blocking includes dialog that prevents decision-making. Dominating and recognition seeking include text instances that emphasize issues in her classroom but do not aid in the completion of the task. Avoiding are text instances when the discussion is not concerned with the task for the chat. Linda eventually decided to end Phase 2 without using the online student groups to develop distributed expertise.

Table 2:

Anti-Task Roles



Progressive Issue #2: What factors in individual teachers' school environments influence the implementation of a constructivist-based learning environment?

In response to contextual aspects she was supported in this unit by her principal and other eMINTS teachers in her building. She was allowed to not departmentalize during the unit so her students could complete the unit. She described a supportive environment for her innovation in her pre-unit interview but expressed hesitation in the structure of the learning environment:

> Researcher: Have you talked with others in your building about your participation in the pilot?
>
> Linda: I can see the possibilities and the possibilities are so incredible even when we go beyond Missouri. Especially in science as far as you could go coast to coast and it left us wondering how to put all the pieces together and I am still not sure how to do that. After the project I hope to be able to talk very knowledgeably about it. I am not just there yet. I see all the possibilities and the wonderful things that could happen. I am just able to talk to other people how to make that happen. Even though I am excited I am not sure what the next step is.
>
> She (the principal) lets us take on a leadership role in our building and allows us to share it with other teachers in our building. She has given us projectors and smart boards and allowed us to travel all over the place so that the teachers can try it out. Last year we focused on equipment training. But this year she is really into the inquiry aspect and she is opening the year out with a discussion on inquiry and project-based learning. I don't know but talking with others in the program if you don't have that it makes it difficult to believe it wholeheartedly and share it with others. We are very fortunate to have that commitment to share.

A tension arose in her local context concerning the departmentalization. She was scheduled to do lessons with another fourth grade teacher. She was able to work this contradiction out by talking with the teacher in her building and she continued the unit with her students in her classroom. She did not have any unresolved local context issues throughout the unit.

Progressive Issue #3: How do teachers' beliefs about learning and technology influence the implementation of a constructivist-based learning environment?

In order to understand the teachers beliefs about learning we coded the learning goals for students as motive. Using Bereiter's Scheme of Knowledge (2001), we developed a hierarchical coding structure to demonstrate changes in the teacher's beliefs about the potential learning resulting from implementing the innovation cluster. When the teacher described her learning goals for their students throughout the implementation of this unit, we coded these text instances at some level of this scale. During the pre-unit interview Linda was focused on the type of learning environment that involved students in solving complex problems collaboratively so they could understand others points of view. Demonstration of this type of knowledge is a level 5 on the coding scale because it shows an awareness of knowledge as functioning to aid in solving problems and communicating understanding to others. Linda wanted her students to be involved with the other students online in order to understand different points of view. When asked what her goals for the students would be in the unit she said, "Their understanding that solving the problem is not solving the problem here [is important] but taking into account everybody else's is really important to me." She re-voiced her goals for her students the unit in a post-unit online interview.

> Linda: The students looked at the I-70 from many angles, local as well as statewide. They learned a lot about how MoDot attacks problems and works together to

> solve them. They also learned the importance of looking at what others have done to solve similar problems. They did this by studying case studies from various places. The project was set up in phases that flowed very well. Each phase provided the students with opportunities to help them understand the problem at various levels.

Linda expressed very definite learning goals for her students through the implementation of the unit design template and the technology of SNS. She understood the nature of problem-solving and its benefit for the students. However, her in-class instructional responses to the implementation were coded at lower levels than the learning goals she described in the pre and post unit interviews. The activities she implemented during the unit required the students only to present what they know or describe why they know it. These activities were coded as Level 2 on Bereiter's Scheme of Knowledge.

> Linda: (Chat 2- Phase 1 activity) I thought as an activity to look at the facts we find and for the kids to show what they've learned we could create graphic organizers in Inspiration.

> Linda: (email to researcher- Phase 1 activity) Wow what a first day we had!! We started out doing a KWL about what we knew about I-70. Then we watched the trailer looked at maps to see where I -70 is and what states it encompasses. We when watched the trailer and the kids started coming up with some really good comments and questions. We then read 5 different articles I had copied out of the Independence Examiner (the Star now makes you pay for this service: -( )about I-70 and the kids had to try and come up with a list of positive and negative affects the interstate has on our city. When we discussed their lists they came up with some really good ideas about how much other people who actually drive would maybe know. Some kids really got into this!! I was excited. I kind of let them navigate what direction we would go next.....which I think is a bit of inquiry :-)!! So far I feel like we have a good start with gathering information, using facts and statistics, we have presented information in small groups and through the DB, we talk everyday about managing our teams, and some kids are doing a great job with problem solving.

She initially understood the importance of the online collaboration process offered by the SNS tools especially during Phase 2 when all the classes were scheduled to chat concerning the problem. However when she reached Phase 2 she did not implement these interactions that could lead to the types of learning responses that she described as her motive for initiation. Below is text from Chat 7 which occurred during Phase 2 where Linda expresses her inability to define the classroom dynamics for herself and her students:

> Linda: Many of my kids felt frustrated today as I did it. We were trying to learn more about their specific jobs, but couldn't find resources that could help them. We looked at the case studies and tried to figure out what their roles may have been in those situations, but it was really hard. We did do the survey today, also. I posted the questions with the job descriptions on the web page and that's what I had my kids use as a guide as we researched their jobs. Some of them did great with this, but many of my kids are feeling frustrated. We had such a good experience with Phase I. I'm just not sure how to help them with this part.

In her post unit interview she defined her learning goals for her students "I wanted the students to not only learn about the problems I-70 has, but the many ways we rely on it. Also, I wanted the students to realize how real experts attack a problem of this magnitude and how much research and collaboration it takes in order to come up with valid ideas." The problem-solving process

during Phase 2 required the students to understand the overall goals of experts in the eight expert areas related to the solution. The students had to define their areas and then present a strategy for a possible solution. Phase 2 included collaboration with the other online classes in the process of defining their strategies for a solution. In Phase 2 all the groups were comprised of two students in each class with their group work done online using the group work tools available in SNS. These communications were designed into the unit to facilitate the students' understanding of multiple perspectives and the identification of expert knowledge needed in order to solve the authentic problem. Without these online collaborations, students can only develop problem solutions from their own local perspective.

Linda's previous inquiry training at eMINTS emphasized how to build Web Quest inquiry activities that are teacher-directed. Linda had previously done KWL's, which include defining what you Know, what you Want to know and what you Learned, as an inquiry project. This type of inquiry is teacher-directed and fundamentally dissimilar to the type of authentic problem-solving responses defined for the students in Phase 2. The activities in Phase 1 of the unit dealt with Linda defining the problem under study in her own classroom. When Linda moved beyond her previous experience in teacher-driven activities into Phase 2, she felt a level of discomfort with the student activities. Her level of dissonance was too high for her to facilitate the learning activities that can develop these types of learning responses in students and the professional development processes available to her, online chatrooms, were unable to help her resolve this contradiction between her beliefs about learning, motive, and her object, the actual implementation process.

Findings

In the process of implementing the unit, Linda overall narrowed the object relative to her motive. Three turning points developed during the implementation process. She was able to overcome one of them, between local rules and her subject goals, but she was unable to overcome the other two contradictions, between SNS and her object, and the unit framework and her goals, subject. Table 3 is a chart of her responses.

Table 3.

Turning Points in Linda's Object Reformulation

Turning Point	Work Activity System Contradiction	Indicator Of Turning Point	Object Reformulation
1	mediating tools (SNS) vs. object	chatroom conference #8; discussing the implication of inconsistent accessibility of the SNS chatroom among the four classrooms	narrowed; ended Phase 2 without her students interacting with students from other classrooms in the SNS chatroom or discussion board
2	rules (department-alization) vs. subject	phone conference; disturbance cluster (dilemma); discussing the impact of departmentalization	widened (temporal); worked with principal and teachers to not departmentalize
3	mediating tools (unit design framework) vs. subject	chatroom conference #7; disturbance cluster (dilemma); questioning the accessibility of resources for students and functionality of forming expert areas	narrowed; lowered expectations for student outcomes to align more closely with her beliefs of teaching and learning

In the chart above we identified turning point number #1 as a tension between the mediational tool, SNS, specifically the accessibility of the chat room and her object, the implementation of the unit. During Phase 2 she found that the server was down in one of the other classes when she needed it for the chats scheduled in Phase 2. She discussed the possibility of using the discussion board as a forum for this dialog with the other teacher. She did not schedule this interaction. Instead she moved her students into Phase 3 without any online dialog with the other classes. She was unable to overcome this aspect of the unit implementation to develop other sources of communication to facilitate this communication process and the type of knowledge response she intended for her students.

Identified as Turning Point number 2, she was able to resolve a contradiction between rules, her scheduling in the building, and, subject, her goals for the unit. She communicated her learning goals for her students and the need for her to keep her students to the principal and the other teachers. She was able to overcome this local contradiction by talking and working collaboratively with the teachers and administrators in her building in order to change the departmentalized rules in her building and keep her students in her classroom.

Identified as Turning Point number 3, she had a contradiction between the subject, her own goals and beliefs about the unit, and the mediation of the unit design template, Phase 2 activities specifically. She was uncomfortable with the more open-ended inquiry wherein she did not control the aspects of content and the dissemination process. Her emails and chats expressed her feeling of "being out of control." She identified the potential learning responses resulting from implementation of the unit template but she was unable to resolve the tension resulting from the actual classroom responses that occurred during this phase of the unit meant to develop these learning responses in her students and her own previous experiences and training. She did not use the collaborative professional development to resolve this contradiction. She voiced her frustration in her contacts with the teachers and the researcher during the chats as anti-task responses.

Her inability to resolve these two contradictions, one identified as a mediational contradiction in SNS and the other in the mediation of the I-70 unit, led to her narrowing her object and implementing the unit with lowered levels of learning responses and student response activities than those she expressed in her pre unit interview. She was unable to resolve the contradictions that occurred during the implementation process that dealt with the in-class learning behaviors necessary to implement an authentic problem-solving unit such as open-ended chat dialogs, group work online, lack of predefined questioning processes and the control of resources online. She did not use the online professional development collaboration to resolve contradictions.

Figure 2 is a graphical representation of Linda's AT work activity. The solid broken lines represent contradictions that were unresolved. The dashed broken lines represent resolved contradictions. She did not have tensions in her local context that she could not resolve. Her local aspects of AT, community, division of labor and rules, were supportive of her decision to implement the reform unit. However, both of the mediational tools, SNS and the unit design template, led to contradictions during the implementation. She did not resolve the contradiction between her goals for the students and the actual practice of implementing an authentic problem-based unit. She did not develop the advanced online communication processes that were possible using SNS during the implementation. As a result, her students did not participate in the type of problem-solving behaviors she discussed in the pre-unit interview. In the post-unit interview she said she would not implement a problem-based unit again because "it does not include enough MAP content knowledge."

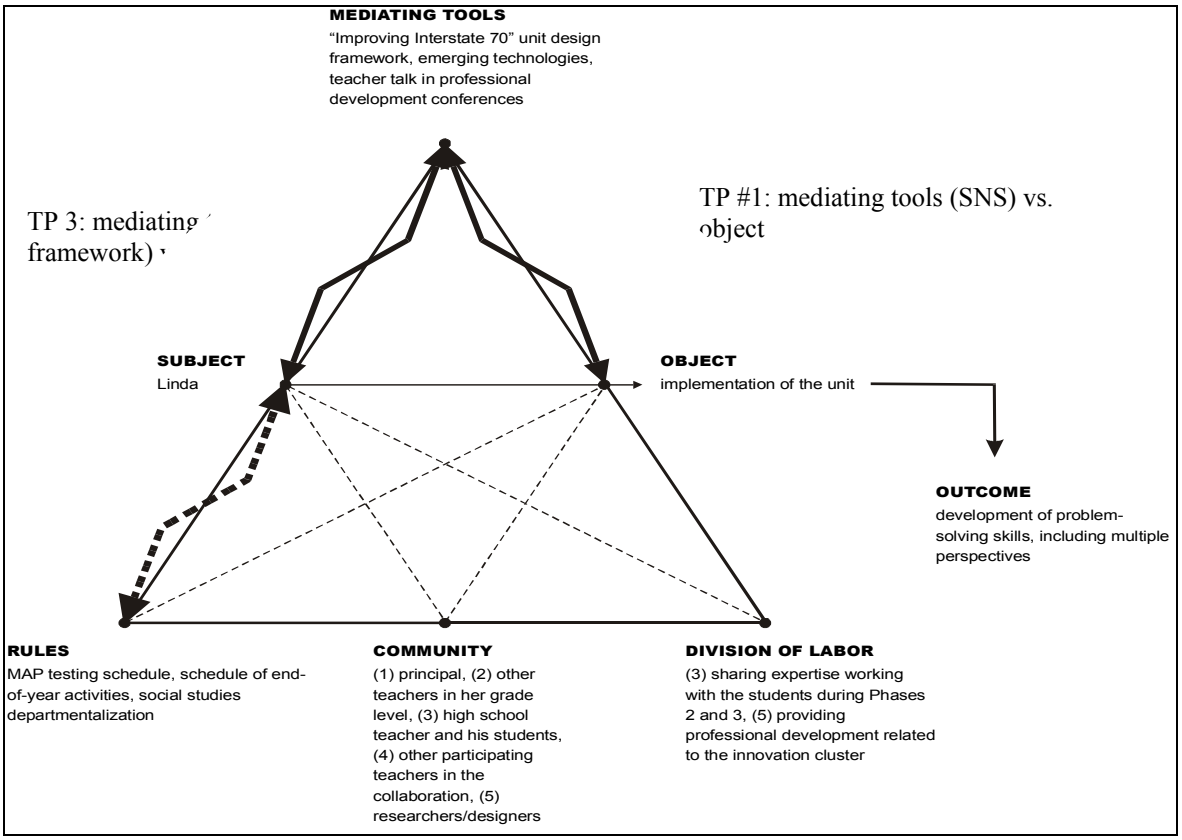


Figure 2: AT Model of Linda's Work Activity

Conclusions

Collaborative Professional Development

Linda did not overcome contradictions through collaborative professional development. As the unit became more complex in Phase 2 and she was initiating learning activities that she had not previously experienced, her dialog became less productive as coded for task roles during the chats. The collaborative forums, online chats, were not productive for her as the level of innovation increased and her corresponding level of comfort decreased. Her role online involved the dispensing of information not in the shared goal of developing the collaborative unit.

Online collaboration processes can be more productive if the teacher identifies shared goals for the online dialogs to increase productive task responses. If these shared goals are defined as tasks for the collaboration then the teachers can use the forum more productively to meet their goals. The teacher working to implement this unit perhaps could have benefited from a more individualized forum such as a journal or mentoring process that would allow her to address her own levels of discomfort with reform without group review. The online forum also had the constraint of lessening the building of personal relationships prior to and during the implementation of the unit. Professional development models for teachers implementing reform should also consider how often the teacher needs or requests contact. As the level of innovation increases, the teacher may need a positive sustained professional development program which includes mentorship opportunities and the opportunity to share collaborative goals with others.

Local Context

Linda was able to overcome several other contradictions-working out scheduling issues in her building and technology problems in her classroom- without changing her goals. It appears that her community was favorable to the reform processes and the new tools implemented during this unit. She was able to communicate effectively with all important people in her school environment to resolve tensions in her local system. An implication from these statements and conclusions is teachers should anticipate the people and support systems needed to implement reform and then develop a communication process with these people within their local community. When implementing reform, the anticipation of problems and the development of the communication channels needed to solve these problems, is an important aspect of successfully meeting the goals of the implementation process.

Beliefs about Learning

Linda had very defined learning goals for her unit as a result of implementing the two innovations. She did not achieve her original goals because of two mediational contradictions, one related to her concepts about the complexity of the unit itself and the other related to the relationship between the technology and her goals and beliefs about learning. When a teacher implements a reform-based unit, she should identify her learning goals for her students. This proactive process should be built into the professional development model as reflection. Addressing these issues in the form of ongoing questioning built into the professional development model can aid teachers in identifying learning activities that meet their goals. These teachers need a form of professional development that models the activities that lead to types of learning that they want as outcome. They should also identify those factors in the innovations themselves and their local environments that help or hinder them in meeting their outcome and anticipate overcoming these issues in order to provide these learning environments to their students.

Implications

Teachers who are designing and implementing constructivist-based learning environments need a reflective proactive form of communication as part of their professional development in order to "clarify concepts, ideas, and alternative courses of action" (Korthagen, 1993, p. 318). Teachers who design and implement CBLEs must be ready to adapt their instruction to meet the demands of a "complex and multifaceted endeavor" (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991, p.390). However, Sternberg and Caruso (1985) defined teacher knowledge controlling much of teacher responses in the classroom as tacit knowledge, or unreflective knowledge. Previous studies (Clark & Yinger, 1979; Halkes & Olson, 1984) showed that automatic or the mechanical performance of acts constitutes a large amount of teacher behaviors. Elbaz (1991) showed that teachers' knowledge is non-linear, holistic, imbued with personal meaning and largely tacit. Clark found that teachers' actions seem to be governed by rules and routines, with decision-making in a studied, deliberate sense taking a minor role in their interactive thinking. Studies have shown the importance of the identifying the pedagogical and philosophical basis for teachers' responses to the classroom.

Korthagen defined a teacher education model that he called the realistic approach. He suggested that much of teacher behavior is based on previously acquired concepts that he said formed a "gestalt" theory of how teachers respond. He described a gestalt as a "complex interplay between social, cultural, psychological, and physical factors that are linked to concrete situations."(Korthagen, 1999, p. 9). However, he also described the difficulty of changing a gestalt, as in the implication of new teaching procedures. Identification of the gestalt theories, the

interplay of episteme and phronesis that result in behaviors in the classroom is a major aspect of implementing a reform-based professional development program.

The impact of reflection in teacher professional development has been studied previously (Elbaz, 1991; Schon, 1987; Clark & Yinger, 1979; Halkes & Olson, 1984). These studies have shown how creating a professional development program that helps teachers identify tacit knowledge and the types of knowledge and understandings that aid them in developing new pedagogical and philosophical concepts in order to implement reform. Korthagen suggests working reflection through the process of identification of holistic gestalt structures in order to change schema and create a new theory of education The challenge and support gained through social interaction is important in helping teachers clarify what they believe and in gaining the courage to pursuer their beliefs" (Zeichner & Liston, 1996, p. 76).

Teachers implementing reform in the classroom take on an extremely complex and difficult task. Especially when implementing two innovations, a new curricular structure and a new technology each interwoven with the other, the teacher needs to be aware of both her philosophical motives for the implementation of the innovation, episteme, and her practical instructional experiences, phronesis, and how either could potentially impact the development of her goals and ultimately the successful integration of innovation in an educational settings.

Online Professional Development for Innovative Educators

An online collaboration forum among innovative educators needs to be designed to meet their specific professional development needs. The implementation of an innovation means a change in some fundamental aspect of a teacher's practice whether it is her beliefs about learning, the contextual support systems in her school or the types and qualities of the collaborative professional development. In order to develop collaborative support systems the innovative educator needs to be supported online with programs of interactions between teachers working on similar innovations and also mentors who have developed similar or more advanced innovations. This dialog should include both synchronous and asynchronous dialogs that are structured around the proactive anticipation of in situ stressors that can occur at differing stages of implementation. Anticipatory problem identification and problem-solving in her local context is an important approach for the innovative educator. The online professional development program can aid in the development of these responses by presenting case studies or exemplars for the teachers to consider and dialog about prior to, and throughout, the implementation. Throughout the implementation, ongoing reflection on the teacher's learning goals for the implementation of the innovation is important for the successful development of reform. This process can be augmented online through collaborative dialogs that are structured around new theories and ideas about learning but also needs to be supported through private online interactions such as emails and journaling online so educators can voice concerns in a timely and more intimate manner. Teachers developing innovation need an online professional development program that supports their efforts to implement change. The paradigm shift that needs to occur for educators to be successful innovators requires a supportive professional development program that aids them as they attempt to make educational systems more responsive to the needs of a rapidly changing technologically-based society.

References

Aronson, E., Blaney, N., Stephan, C., Sikes, J., & Snapp, M. (1978). The Jigsaw classroom. Beverly Hills, CA: Sage Publications.

Barab, S. A., & Duffy, T. (2000). From practice fields to communities of practice. In D. Jonassen & S. M. Land (Eds.), Theoretical Foundations of Learning Environments (pp. 25-56). Mahwah, NJ: Lawrence Erlbaum Associates.

Barab, S. A., Hay, K. E., Yamagata-Lynch, L. C. (2001). Constructing networks of activity: An in-situ research methodology. The Journal of The Learning Sciences, 10(1&2), 63-112.

Bednar, A. K., Cunningham, D., Duffy, T. M., & Perry, D. J. (1992). Theory into practice: How do we link? In T. Duffy & D. Jonassen (Eds.), Constructivism and the technology of instruction (pp. 17-34). Hillsdale, NJ: Lawrence Erlbaum Associates.

Bereiter, C. (2002). Education and mind in the knowledge age.

Blumenfeld, P.C., Soloway, E., Marx, R., Krajcik, J.S., Gzdial, M., & Palincsar, A. (1991). Motivating project-based learning: Sustaining the doing, supporting the learning. *Educational Psychologist, 26,* 369-398.

Brown, A. (1995). The advancement of learning. Educational Researcher, 23(8), 4-12.

Bruner, J. (1984). Vygotsky's zone of proximal development: The hidden agenda. In B. Rogoff J. Wertsch (Eds.), Children's learning in the "zone of proximal development: New directions for child development. San Francisco: Jossey-Bass.

Clark, C.M., & Yinger, R. J. (1979). Teachers' thinking. In P.L. Peterson & H.J. Walberg (Eds.), Research on teaching: Concepts, findings, and implications (pp.231-263). Berkeley, CA: McCutchan.

Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the craft of reading, writing, and mathematics. In L. B. Resnick (Ed.), Knowing, learning, and instruction: Essays in honor of Robert Glaser (pp. 453-494). Hillsdale, NJ: Erlbaum.

Elbaz, F. (1991). Reserarch on teachers' knowledge: The evolution of a discourse. Journal of Curriculum Studies, 23(1), 1-19.

Engeström, Y. (1987). Learning by expanding: An activity-theoretical approach to developmental research. Helsinki: Orienta-Konsultit.

Fraenkel, J.R., & Wallen, N.E. (1996). How to design and evaluate research in education. NY: McGraw-Hill, Inc.

Halkes, R., & Olson, J.K. (1984). Introduction. In R. Halkes & J. K. Olson (Eds.), Teacher thinking: A new perspective on persisting problems in education (pp. 1-6). Lisse: Swets & Zeitlinger.

Kärkkäinen, M. (1999). A longitudinal study of planning and implementing curriculum units in elementary school teacher teams. Retrieved March 3, 2002, from University of Helsinki, eThesis: Electronic Publications at University of Helsinki: http://ethesis.helsinki.fi/english.html.

Korthagen, F. (1993). Two modes of reflection. Teacher and Teacher Education, 9(3), 317-326.

Jonassen, D. H. (2000). Toward a design theory of problem solving. Educational Technology Research and Development, 48(4), 63-85.

Jonassen, D.H., & Rohrer-Murphy, L. (1999). Activity theory as a framework for designing constructivist learning environments. *Educational Technology Research and Development, 47*(1), 61–79.

Laffey, J., Musser, D. & Espinosa, L. (2000). Shadow netWorkspace™ Learning Systems Project. Proceedings of the International Workshop on Advanced Learning Technologies. (Palmerstown North, New Zealand), IEEE Computer Society. pp. 188-189.

Lave, J., & Wenger, E. (1991). Situated learning: Legitimate peripheral participation. Cambridge, UK: Cambridge University Press.

LeCompte, M.D., & Preissle, J. (1993). Ethnography and qualitative design in educational research (2nd ed.). San Diego, CA: Academic Press, Inc.

Leont'ev, A.N. (1978). Activity, consciousness, and personality. Englewood Cliffs: Prentice-Hall.

Maykut, P., & Morehouse, R. (1994). Beginning qualitative research: A philosophic and practical guide. Bristol, PA: Falmer Press.

Pea, R. (1993). Practices of distributed intelligence and designs for education. In G. Salomon (Ed.), Distributed cognitions: Psychological and educational considerations (pp 47-87). Cambridge, UK: Cambridge University Press. Resnick et al., 1991).

Rogers, E. M. (1995). Diffusion of innovations (4th ed.). NY: The Free Press.

Salomon, G. (1993). No distribution without individuals' cognition: A dynamic interactional view. In G. Salomon (Ed.), Distributed cognitions: Psychological and educational considerations. NY: Cambridge University Press.

Schön, D. A. (1987). Educating the reflective practitioner. San Francisco: Jossey-Bass.

Sternberg, R.J. & Caruso, D.P. (1985). Learning and teaching, the ways of knowing. In E. Eiser (Ed.), *Practical modes of knowing* (pp. 133-158). Chicago: University of Chicago Press.

Wertsch, J. V. (1998). Mind as action. NY: Oxford University Press.

Wertsch, J. (1991). Voices of the mind. A sociocultural approach to mediated action. Cambridge: Harvard University Press.

Zeichner, K. & Liston, D. (1996). Reflective teaching: An introduction. New Jersey: Lawrence Erlbaum Associates, Inc.

About the Author

Donna Russell has a BA in elementary education, a master's degree in Curriculum and Instruction and a doctoral degree in Educational Psychology with an emphasis on Cognition and Technology. She has 14 years experience teaching and implementing research in varied K-12 educational settings.

Dr. Russell is an Assistant Professor in the Curriculum and Instructional Leadership department at the University of Missouri- Kansas City. She has designed and is implementing a new master's degree in curriculum and instruction with an emphasis on learning technologies at the university. Her research areas include the systemic qualitative analysis of technology integration in diverse urban settings, innovation in educational settings and online learning environments.

She may be reached via email at: russelldl@umkc.edu.

Editor's Note: Contemporary university educators who are striving to improve their student's use instructional of technology will benefit from the excellent work of Moti Frank and Abigail Barzilai. Educators who have designed a course web site or plan to build one in the near future will find valuable insights that will help them to create a pedagogically sound site. The authors share research based advice on the kind of web site resources that will encourage meaningful student learning.

Designing course web sites for supporting lecture-based courses in higher education – some pedagogical aspects

Moti Frank, Abigail Barzilai

Keywords: Learning; Course web site; Course support site; Pedagogy; Active learning; Computerized feedback; Multimedia; Constructivism; WebCT; Higher Education; Asynchronous Learning; Distance Learning.

Abstract

This paper discusses the benefits that may be derived from a course web site that accompanies a lecture-based course given in higher education institutions. The organizational and operational issues are presented first, following by a discussion of pedagogical aspects. Three pedagogical issues related to course web sites are discussed in detail – active learning, computerized feedback, and the effects on learning of using multimedia. Some findings, based on collected data and the authors' experiences, are also presented and discussed. The conclusions are that the advanced technology exists but it seems that instructors in higher education still tend to build course web sites that underutilize the technology's potential. On the other hand, using technology simply because it is there does not assure effective learning. Technology must be a means – not the aim. The pedagogical considerations and the ways of using the technology to achieve the pedagogical benefits are what is important.

1. Introduction

Over the past few years, with the rapid development of technology, we see crystallization of three approaches for using e-learning in higher education. The first approach is a lecture-based course also available through a web site (course-support site). In other words, lectures are given in the traditional manner but in parallel a web site is built on behalf of the course for exercises and practice drills, supplement, enrichment, and in-depth study of the subject. The second approach – a fully on-line asynchronous course – requires only a very limited number of classroom sessions. The primary teaching is conducted through the course web site. This contrasts with the third approach – synchronous distance learning. In this approach, teaching resembles, in some of its features traditional teaching yet nevertheless, the teacher and his or her students are physically distant from one another.

This paper focuses on the first approach - creating a course web site for face-to-face-based course (course-support site) – and discusses the advantages and challenges that this approach offers lecturers. The aim of the paper is to consider issues associated with teaching and learning when using course-support sites. Various options of teaching and learning strategies that can be used in web-based learning environments will be discussed. Some findings, based on collected data and the authors' experience will be presented and discussed.

2. Developing a course web site for lecture-based course (course-support site)

2.1 Introduction

This section discusses pedagogical and other aspects of a learning environment that integrates traditional teaching methods and the use of a course web site. For hundreds of years now the lecture method (sometimes called frontal teaching or face-to-face-teaching) has been considered to be the primary teaching method. The lecture has its benefits and limitations. Many teachers think that the lecture is still the most efficient teaching method for delivering the basic content of a given subject matter with the teacher having control over what is happening in the classroom. This teaching method is sometimes perceived as the most convenient and 'economic' method for delivering ample material to a large number of students. Participating in the lessons, asking questions, making notes, and discussing issues with the teacher, will probably continue to be among the major characteristics of teaching in the coming years. The main criticism about lectures as a teaching method is that students are allocated a passive role and thus their studying efficiency is low.

Nevertheless, the use of innovative educational technologies is growing. In recent years we have been witnessing considerable growth in the number of courses with web sites meant to serve as tools for augmenting traditional teaching. A well designed course web site will function as a complementary tool to the classroom lessons and raise the learning effectiveness through active and interactive studying. In many Learning Management Systems (packaged software for building course web sites) active and interactive learning tools are intrinsic and web site designers can use them for applying active learning principles.

An enormous amount of books, articles, papers and chapters deal with the internet as a learning environment in education. In much of the research, no significant differences were found between an e-teaching/learning environment and the traditional teaching/learning environment in relation to the variables that were examined. Yet, many other studies did find significant differences. It seems that the real question is not whether it is possible to elicit benefits from a course web site in learning environment that integrates traditional teaching methods with the use of a course web site, but under what conditions can this be achieved.

2.2 Some benefits that may be derived from course web site

Planning and designing a course web site is not an easy task. It requires investment of a lot of effort and usually consumes a great deal of time. Many researchers refer to organizational and operational advantages that may be achieved from a course web site such as accessibility and flexibility.

Building course web site by using Learning Management System is relatively simple. Learning Management Systems allow course designers to choose among many options for organizing courses and applying pedagogical principles.

Using the internet as a delivery medium can lead to a tendency to design instruction based only on the technological capabilities, rather than on pedagogy considerations, core instructional elements, the needs of the learner, and the achievement of independent learning strategies. Technology can provide not only presentational and organizational functions, but can also support communication, feedback and interaction between students and teachers. The instruction strategy of such courses needs to be based on theories about learning and how knowledge is constructed (Oliver & McLoughlin, 1999).

However, one inherent advantage of a course web site is the ability to implement four dimensions of "good teaching" – applying active and interactive learning principles, using multimedia,

organizing the course and its lessons, and providing immediate feedback to students about their progress. Students must be active and interactive; teachers must organize their courses and the material for the lessons in advance through "trees" that make orientation easy; the software enables easy transmission of feedback, and the web site should be able to assist by providing an option for using multimedia and multiple representation means such as text, charts, graphs, tables, illustrations, pictures, sketches, animations, simulations, equations, light, color, and sound. The rest of the "good teaching" dimensions (Hativa, 2000) – the ability to give (written) clear and interesting presentations and explanations, and the capacity to build a supportive learning environment – depend on the course teacher.

A well-designed course web site should provide (automatic) immediate feedback to students as well as hints and directions on how to continue in case of mistakes. Through the web site, the learner can be exposed to multiple realities. The teacher can place challenging inquiry tasks, present and discuss paradoxes and contradictions, and initiate reflection on the learning processes.

A course web site may nurture development of independent learning. The learning through the course web site is according to the pace, style and level that is suitable for each learner. By using the course web site, if well designed, learning can reach a depth unlikely to be attained in the face-to-face lessons, since students can invest as much time and effort as required, each according to his or her learning tempo. This contrasts with synchronous and frontal teaching classes, which have a time limit and progress at a uniform pace that is not necessarily suitable for each student. When the teacher assigns questions/tasks through the course web site students have enough time to think before giving their answers – a luxury not always available in frontal or synchronous classes (Bhattacharya, 1999; Branon and Essex, 2001).

2.3 Challenges when using a course website

Lister (1999) noted that in certain cases the problem of motivation in asynchronous lessons may arise. Lacking a serious incentive, students may not make the effort needed to learn through the web site.

In asynchronous lessons the teacher cannot see the students' reactions to the study material. He or she may miss out on facial expressions or body language, for instance (Wolcott, 1995; Hill, 1997). In fact, several researchers related to the difficulties arising from lack of eye-contact between teacher and student, as in distance learning. Willis and Dickinson (1997), for example, wondered whether teachers can be effectual if they are unable to maintain eye-contact with their students, or to observe students' non-verbal behavior. In order to create a course web site teachers must invest great effort in writing up the course content (in the case that these were not prepared beforehand).

3. Three pedagogical issues related to course web sites: active learning, computerized feedback, and multimedia

3.1 Active learning: The constructivist approach and its implementations for teaching

The main pedagogical basis for e-learning is active learning. Many elements of the active learning approach are derived from principles of the constructivist teaching approach. This section outlines in brief the principles of the latter approach and their application to teaching.

Constructivism is a theory that regarding learning and knowledge that suggests that human beings are active learners who construct their knowledge both from personal experiences and their efforts to give meaning to these experiences. According to this approach, the learning

environment should enable students to construct their knowledge through active learning and trial and error.

Constructivism suggests that learners learn concepts or construct meaning about ideas through their interaction with others, with their world, and through interpretations of that world by actively constructing meaning. They cannot do this by passively absorbing knowledge imparted by a teacher. Learners relate new knowledge to their previous knowledge and experience. A constructivist model of teaching has five characteristic features: active engagement, use and application of knowledge, multiple representations, use of learning communities, and authentic tasks (Krajcik, Czerniak & Berger, 1999).

The teacher's task, according to this approach, is to tutor students and teach them how to learn. He/she is not a mere 'purveyor of knowledge' or 'provider of facts', but is, rather, a mentor, facilitator, helper and mediator for learning. The teacher must create a learning environment that will allow the student to construct his/her own knowledge by experiencing and interacting with the environment (Hill, 1997). An e-learning strategy, if designed correctly, may provide precisely such a learning environment.

Many researchers testify to the efficiency of active learning. For example, Hake (1998) examined 6542 students who participated in physics courses. He found that the conceptual understanding and the problem solving ability of students who applied interactive-engagement methods in their studies was significantly higher than students who studied in traditional methods.

3.2 Visualization and multimedia: Images, animations, and simulations

Introduction. The term "multimedia" refers to a combination of multiple technical resources for the purpose of presenting information represented in multiple formats via multiple sensory modalities (Schnotz & Lowe, 2003). Accordingly, multimedia resources can be considered on three different levels: the technical level (i.e., computers, networks, displays, etc.); the semiotic level, referring to the representational format (i.e., texts, pictures, sound, etc.); and the sensory level (i.e. visual or auditory modality).

Here, we will relate mainly to the sensory and semiotic levels. Many educators assume that creating learning environments that contain visual and auditory effects while using tools such as animations and videos is sufficient for promoting cognitive processing and constructing elaborate knowledge structures. However, in many research studies it was found out that the use of visual and auditory effects does not necessarily improve learning and, thus, using technology per se does not guarantee success. In order to improve learning processes, the instructor has to plan correctly the manner in which the information is presented and to refer to its sensory and semiotic aspects.

The effects on learning of using illustrations. In a series of four laboratory experiments, Mayer (2003) checked under which conditions the addition of illustrations to a text, written or vocal, fosters meaningful learning. It was found that students learn more deeply: from words and pictures than from words alone; when extraneous material is excluded rather than included; printed words are placed near rather than far from corresponding pictures; and when words are presented in a conversational rather than formal style. A possible explanation for these findings is that learning is more meaningful when the information is absorbed via two channels – auditory and visual, when learners pay high attention both to words as well as to pictures, and when they integrate the verbal representations with the visual representations, and between them and prior knowledge.

In another lab experiment (Schnotz & Bannert, 2003) it was found that presenting graphics is not always beneficial for the acquisition of knowledge. Whereas task-appropriate graphics may support learning, task-inappropriate graphics may interfere with mental model construction. Pictures facilitate learning only if the learners have low prior knowledge and if the subject matter

is visualized in a task-appropriate way. If good readers with high prior knowledge receive a text with pictures in which the subject matter is visualized in a task-inappropriate way, then these pictures may interfere with the construction of a task-appropriate mental model. The researchers behind this experiment concluded that the structure of graphics affects the structure of the mental model. In the design of instructional material including texts and pictures, the form of visualization used in the pictures should be considered very carefully.

Animations effects on learning. Animation is a dynamic depiction that can be used to make change processes explicit to the learner (Schnotz & Lowe, 2003). Many educators believe that animations are superior to static illustrations as tools for learning. In order to comprehend a dynamic situation that is externally represented by a static graphic, the learner must first construct a dynamic mental model from the static information provided. In contrast, animations can offer the learner an explicit dynamic representation of the situation. On the other hand, the transitory nature of dynamic visuals may cause higher cognitive load because learners have less control of their speed of processing. Lowe (2003) and Lewalter (2003) showed that merely providing learners with the dynamic information in an explicit form does not necessarily result in better learning.

An experimental study with 60 physics students, conducted by Lewalter (2003), investigated the effects of including static or dynamic visuals in an expository text on a learning outcome. She found that either adding animations or adding static illustrations can result in better learning. However, she found no difference between animations and static illustrations with respect to knowledge acquisition about facts, and only a small non-significant difference in favor of the animation group with respect to comprehension. Kozma (2003) found that with regard to the use of representations, such as animations and video segments showing lab experiments, chemistry experts may extract more benefits than chemistry novices. Lowe (2003) found that explicit presentation of the dynamic aspects of the content in a multimedia learning environment does not necessarily have a positive impact on learning. In many cases, the use of static visuals including conventional signs for motion, such as arrows, or the use of a series of frames may be sufficient for learning.

To review, the use of advanced educational technology as such does not assure a positive effect on learning. In order to improve learning, the instructor has to thoroughly plan the use of pictures and animations according to the following principles: students learn more deeply from words and pictures than from words alone; pictures facilitate learning only if the learners have low prior knowledge and if the subject matter is visualized in a task-appropriate way; animations are more effective when the learner can control the pace and the direction; even animations allowing a high degree of user control should incorporate considerably more support and direction if they are to function as effective tools for learning; and in science teaching, it is not sufficient to present virtual experiments. Students must participate in hands-on experiments as well.

3.3 The Effects of Computerized Feedback Intervention on Learning

Definition. "Feedback interventions are defined as actions taken by (an) external agent(s) to provide information regarding some aspect (s) of one's task performance" (Kluger & DeNisi, 1996). This definition excludes several areas of investigation: (1) natural feedback processes such as homeostasis, intrinsic feedback, or the negative-feedback-loop of a control system that operates without an external intervention; (2) task-generated feedback which is obtained without intervention; (3) personal feedback that does not relate to task performance; and (4) self-initiated feedback-seeking behavior. We concentrate here on feedback intervention given to the student by an external agent (the teacher) as regards certain aspects and outcomes of the learning process. The feedback could also be automatic – the computer, both in SDL and asynchronous on-line courses returns feedback, which is prepared by the teacher in advance.

Following a literature review it seems that the question on which we should focus is not whether feedback should be given, but how it should be designed in order to improve learning. Based on research findings, a short discussion about the conditions under which computerized feedback has a positive effect on learning is presented below.

The effects of feedback on performance. *Many organizational psychology research studies show that feedback has a positive effect on performance level. Thus, for example, according to Locke and Latham (1990), a meta-analysis of 33 investigations showd that in relation to pre-defined goals feedback is more efficient than in a situation where goals were defined and feedback was not given or a situation in which feedback was given but no goals were defined.*

The educational literature has plenty of evidence showing that well-designed feedback given by teachers has a positive effect on learning (Cronbach, 1977; Natrielo, 1987; Crooks, 1988; Black & William, 1998; William, 2002). For example, according to Cronbach (1977), "... feedback or knowledge of results ... [is] the strongest, most important variable controlling performance and learning ... It has been shown repeatedly that there is no improvement without knowledge of results, progressive improvement with it, and deterioration after its withdrawal" (p. 404). And William (2002) summarizes, "After a year, we found significant improvements in the attainment (as measured by external tests) of students taught by teachers using formative assessment, compared with controls in the same schools".

Since this section focuses on feedback provided (automatically) by the computer, let's examine if there is a significant difference between regular teacher feedback and computerized feedback in relation to the effect on learning. Early (1988) found that immediate feedback given by the computer stimulates more confidence, leads to better self-efficacy, and improves performance compared to feedback given by the teacher, verbally or in writing. A possible explanation could be that feedback given by the teacher might detour the student's attention to "him/herself" (i.e., the student will attempt to understand the teacher's intentions, compare him/herself to others, perceive the feedback as something that is being subjectively aimed at him/her personally, perceive the feedback as a threat or even as offensive in certain cases). On the other hand, feedback given by the computer focuses the attention on the task. Jackson (1988) and Kumar and Helgeson (2000) also found that immediate feedback given by a computer is more efficient than feedback provided through traditional methods.

Does feedback always have a positive effect on performance? Kluger and DeNisi (1996) argued that feedback could cause various effects on performance — in certain situations feedback improves the performance level, in others there is no significant effect, and at times there is a negative effect. That is why just providing feedback is insufficient. In order for feedback to have a positive effect, one should plan it properly. The following are a few aspects to be taken into consideration when planning to provide feedback.

Negative feedback. Here, the term "negative feedback" refers to feedback about a mistake made by a student. According to Kluger and DeNisi (1996), feedback influences the student's feelings of well being and alertness and, therefore, performance as well. Negative feedback could also have an unintended emotional influence. When an individual is given negative feedback, he/she evaluates the level of his/her performance in relation to the goal, and accordingly, he/she can proceed using one of four strategies: redouble the effort in order to meet the goal; decrease the goal level to one that can be achieved; reject the feedback; or give up and "run away" (physically or mentally) from the situation. Repetitive negative feedback might induce a reaction of learned helplessness.

Of course, the teacher must create a learning environment that leads the student to choose the first strategy – redouble the effort in order to achieve the goal. Practically, feedback about a mistake that directs the learner to interpret the mistake and challenges him/her toward additional thinking

paths would be more efficient than laconic negative feedback, such as "you made a mistake, try again!"

Positive feedback. Surprisingly, positive feedback does not necessarily results in better learning. Many researchers (see Kluger & DeNisi, 1996) found that praise could also harm performance. For example, feedback that is "too good" may encourage low effort by the student. A teacher, who is effusive with his/her commendation, even when there is no justification for it, might cause nonconfidence (why exert oneself if the teacher praises everything anyway in order to form an positive climate in the classroom or in order to encourage students). So, in order to improve performance positive feedback and praise should relate directly to the task.

Positive feedback, just as negative feedback, should be as detailed and informative as possible. It is not always sufficient to react with a "yes" or "untrue". It is advisable to add an explanation such as: your answer is not correct because…; or "the right answer is B since …; answers A and D are wrong because …; answer C is wrong because …, etc.

In short, immediate feedback given by the computer could, if it is correctly designed, stimulate more confidence, lead to better self-efficacy, and improve learning compared to feedback given by the teacher, verbally or in writing. Through the investment of little effort it is possible to design feedback provided by the computer through the course web site so that a positive effect on learning is achieved. The feedback must: be focused and specific to the task; contain relevant and detailed information; be given immediately; direct the learner to understand his/her mistake; challenge the learner toward additional thinking paths; and point at other possible solutions. The teacher should also present the aims of the course and the learning goals.

4. Method

The Technion – Israel Institute of Technology is Israel's leading technology university. It has 19 engineering and science faculties, in which approximately 13,500 students are enrolled. About 10,000 of these are undergraduates. The remainder are graduates. Over 800 courses are open to students each semester.

The Technion's e-learning policy is that undergraduate and graduate studies must continue to be taught in the traditional fashion of lectures and tutorials. Nevertheless, the Technion encourages its teaching staff to build course web sites for their courses for enrichment, in-depth study, review and practice. When the Technion inaugurated its e-learning project, the WebCT system was selected as its Learning Management System (LMS). However, the Technion administration allowed interested faculties to develop Content Management Systems (CMS) on their own for internal faculty purposes.

Already at the start of the project it was clear that the process would be a gradual one. Therefore, two stages for building the course web sites were delineated. It was decided that in the first stage a standard web site would include administrative information and course content. Administrative information comprised the course syllabus, objectives, goals, policy and requirements; how the course grade would be calculated; information about the teaching staff and their office hours; various instructions; the course timetable; weekly program; exam and quiz schedules and so forth. Course content meant the teaching material for the course, including articles, texts, Power Point presentations, copies of slides, homework assignments and their solutions, past exams and their solutions, links to different relevant web sites, and links to pictures, printouts, and relevant video clips. In addition, the web site had to include basic communication media (for instance, a bulletin board, and discussion groups).

In the second stage course instructors were asked to add interactive components, such as tutorial exercises (usually in the form of multiple-choice questions) for practice on one's own, with

immediate feedback, simulations and animations, management games, model building and running, execution of team projects, material for self-study combined with questions and immediate feedback. Likewise, the web site had to have a frequently asked questions (FAQ) page, as well as an option for allowing students to build their own web pages.

By the year 2000, a limited number of course web sites had been built, under the initiative of lone lecturers who knew how to build internet sites. At that point (the beginning of 2000), the Technion initiated its e-learning project, in its present form, and up to the moment of writing this paper (mid 2004), about 1,300 course web sites have been built. Around 600 of the web sites are based on the WebCT platform; the other sites were built by teaching staff as independent web sites or using the content management systems developed in-house by the respective faculties.

In order to see how much the Technion's course web sites, the WebCT features and the local content management systems are being used, four surveys were conducted. In the framework of the first survey all the web sites – both WebCT-based and local CMS-based – were reviewed. The reviewers examined the content and the tools being used on each web site. The types of tools were divided into four categories: content tools, communication tools, management tools, and interactive tools. During the second survey a questionnaire was distributed to a sample of about 400 students who had taken the courses for which web sites had been built using WebCT. The third survey was actually an analysis of the students' responses to the teaching survey that related to the course web site. In the framework of the fourth survey, another questionnaire, which included open and set questions, was distributed to students who had taken the Technion-wide basic courses in calculus and physics.

5. Major findings and discussion

5.1 Web sites based on WebCT

WebCT is a Learning Management System that was designed with a view to supporting interactive features and offering enhanced support to teachers and learners in using the Internet as a medium of learning (Burgess, 2003). WebCT, as other web-based course support systems, provides tools to enroll learners, deliver the course materials to the learners, and administer and manage the learning (Oliver & McLoughlin, 1999).

WebCT integrates communication tools, including a bulletin board, chat room/s, private e-mail, and a calendar. In addition, text, graphics, video, and audio files can be incorporated into a WebCT site. Such features facilitate interaction between faculty and students (Burgess, 2003). WebCT also provides instructional tools to support course content such as a glossary, references, self-tests, and quiz modules. Students, too, can submit assignments and other materials through WebCT for courses in which they are enrolled. WebCT also gives the instructors tools for grading, tracking student interaction, and monitoring class progress.

From an analysis of the findings it was clear that in six faculties – civil engineering, chemical engineering, biotechnology and food engineering, industrial engineering and management, materials engineering and medicine – the majority of sites are WebCT-based. Nonetheless, there are WebCT-based sites in other faculties also. In total, as previously mentioned, approximately 600 WebCT-based course web sites were identified. In all these sites, administrative data and course content were available. However, only about 15% of the lecturers used the interactive features of quizzes; 10% operated discussion groups; 5% added links to other relevant sites; and only 1% used the glossary feature.

Thus, we see that most instructors used their course web sites as a means to enable accessibility to course material and content and to place messages on the bulletin board rather than utilizing the available interactive features. These findings are corroborated in the literature. For example,

Burgess (2003) found that: "Usage patterns reveal that most WebCT users have not taken full advantage of WebCT capabilities. WebCT as well as other web-based platform were used as a supplement to traditional teaching methods". Dehoney and Reeves (1999) reported on a study that found that the predominant form of web resources among universities were static web pages containing course information and syllabus material. He championed the need for more "pedagogical reengineering" of course materials for web delivery in place of simply enriching conventional courses with web materials.

Students are interested in having course web sites that complement the courses in which they are enrolled. An analysis of the questionnaire completed by around 400 students who participated in courses that had WebCT-based web sites found that 57% of the students believed that WebCT web sites should be built for all Technion courses. In general, it may be said that the students were satisfied with the WebCT system. Fifty-five percent of them thought that using the system contributed "a lot to a great extent" to learning; 50% believed the reaction time of WebCT was "good to excellent"; 50% felt that the system was easy to use to "a great extent": and 48% of the students believed that the technical and pedagogical support of the helpdesk was "very good to excellent".

5.2 Web sites not based on WebCT

Ten faculties developed Content Management Systems. In three of these, the systems offered the following features: in aeronautical and space engineering – syllabus, information about the teaching staff, a bulletin board, lecture content, tutorial content, homework assignments and solutions; computer science – syllabus, information about the teaching staff, a bulletin board, lecture content, tutorial content, FAQs, group discussion, options for getting a grade, list of resources and text books; agricultural engineering – syllabus, information about the teaching staff, a bulletin board, lecture content, tutorial content, homework assignments and solutions, and exams from previous years and their solutions.

The other seven faculties that built CMSs were: mechanical engineering, electrical engineering, mathematics, physics, biology, biomedical engineering, and humanity studies. The remaining three faculties – chemistry, architecture and town planning and education in technology and science – built different kinds of course web sites. To summarize, six faculties set up WebCT-based web sites. Ten faculties used local CMSs and three used other types of systems.

The thirteen faculties that did not use WebCT had 688 web sites. All the sites included syllabi and information about the course teaching staff. In 65% teaching material was offered; in 60% homework assignment pages were available; in 50% there was information about resources and links to recommended sites; 43% made exams from previous years with their solutions available to students; 31% had bulletin boards; 20% gave solutions to homework assignments; 13% had a feature called "find a partner"; in 11% students could find manuals for programs relevant to the course; 7% had set up group discussions; 7% had FAQs; 4% offered formula sheets and a glossary; and only 3% had interactive self-study practice exercises.

5.3 Teaching assessment survey

As in many other academic institutions, the Technion also carries out end-of-semester surveys among its students in order to measure their degree of satisfaction from the teaching. In the last survey, the pollsters inserted an open question that asked the students to write down their comments about the course web sites (if any). After analysis of their answers, researchers found that the comments related to six categories – accessibility and availability, integration of multimedia, bulletin boards, group discussions, solutions to home assignments and supplementing lecture material.

The following are several typical comments.

Accessibility and availability:

- *"It is a big help to have the presentations available on the web site before the lecture…"*
- *"It would be worthwhile uploading all the lecture and tutorial material to the web site."*
- *"How wonderful to have copies of the lectures on the web site…"*

Integration of multimedia:

- *"…more pictures and video clips that actually illustrate the lecture material."*
- *"…in this course there is a lot more room for use of more advanced teaching methods than simply chalk and a blackboard. I am sure that it is possible to find a large number of simulations and animations on the Internet that would illustrate the lecture material."*

Supplementing lecture material:

- *"…the mathematical part of the course was not presented…a full presentation of the mathematical development, even if not given in the lecture, but through the Internet, gives the students who are interested a better understanding."*
- *"…it would be worthwhile putting the development of the mathematical formulae on the Internet site, saving the time in the lectures…"*

Homework assignment solutions:

- *"it would be valuable to add solved exercises to the course web site so as to instill an understanding of the material"*
- *"preferably, the solutions of exams from previous years should be on the web site"*

Group discussions:

"…the forum gave me a lot…it helped me to better understand the material…after I learned using the forum I was able to solve by myself the homework assignments"

To summarize, from an analysis of the raw data that was collected by the survey, it appears that, in general, the course web sites helped the students' learning. In the courses that had web sites, to a large extent students used them mainly to prepare for lectures, to review lecture material, to deepen their understanding (through the multimedia, for instance), to submit homework assignments, to get feedback and communicate among themselves and with the teaching staff.

5.4 Special self-developed course web sites

Two faculties developed interactive systems dedicated to practice exercises. The mathematics faculty developed Mathnet, a system for doing exercises in subjects such as calculus. The physics faculty developed Physweb for submission of homework assignments in physics. These systems serve thousands of students from different faculties who take Technion-wide core courses. Mathnet has three main modules. The first module allows students to prepare for lectures. Prior to every lecture students are presented with informal background material, followed by several interactive exercises. The second module permits student to receive and submit homework assignments. The third module includes tutorial classes that replace classes given in the past in frontal classroom settings. The system allows students to submit exercises, get grades and receive feedback easily. Students can also address questions to the support staff. Physweb is intended for online submission of homework assignments and receipt of immediate feedback.

5.5 Implications

Given the essential difference between the two types of systems – LMS and CMS, it is obvious that course web sites built as content sites will not have interactive components. A comparison of WebCT-based web sites and CMS-based web sites shows that the availability of interactive tools occasionally leads, sometimes only, to the use of these tools. Specifically, it seems that the discussion group tool is a less appropriate learning tool in the basic science courses such as mathematics and physics.

Likewise, among lecturers who used the WebCT system, only some added interactive features. Too often the instructional designs that were employed were attempts to apply traditional learning approaches to this new domain. We see, thus, that using features that have pedagogical benefits (such as active learning, immediate feedback, and use of visualization as explained in section 2, above) is still low. The scope of the use of interactive and multimedia applications is still limited. The work program for the Center for e-Learning must stress this area and encourage the addition of interactive features to course web sites. The implementation team should take action and provide additional training to expose the instructors to unused WebCT capabilities.

Taking our findings into consideration and based on the literature review we recommend to consider the following guidelines. The guidelines are classified to four categories according to four dimensions of "good teaching" – organize the course and its content, apply active and interactive learning principles, provide feedback, and use multiple modes of presentation. Web site designers should review the list given below, to decide, taking into account the course objectives, what is relevant for their course.

Organize the course and its content

- Provide an overview and an orientation of the entire course web site. Provide information about course objectives, priorities, timelines, and responsibilities. Explain how to use the course web site and how the course content is organized. Specify the instructions regarding exams and quizzes.
- Provide links to relevant programs (such as Autocad or Matlab), including examples and manuals.
- Specify the prior knowledge (prerequisite) that is required for the course. Give short summaries of (or links to) relevant resources.
- Present short summaries of learning material that seems to be hard for students to grasp during the lectures.
- Engage and guide students through the course web site by including elements such as weekly announcement, task-lists, new materials, and forums.

Apply active and interactive learning principles, provide feedback

- Use discussion groups for peer and/or group assessment and to encourage student expression and reflection.
- Use an FAQ mechanism for handling students' questions. Encourage students to use it.
- Provide self-assessment quizzes to help students monitor their progress. Give the student feedback and guidance.

Use multiple modes of presentation.

- Plan the use of pictures, images, simulations and animations according to the following principles: students learn more deeply from words and pictures than from words alone;

pictures facilitate learning only if the learners have low prior knowledge and if the subject matter is visualized in a task-appropriate way; animations are more effective when the learner can control the pace and the direction.

6. Conclusion

This paper reviews the benefits and challenges of using course web sites in lecture-based teaching. The advanced technology exists but using technology simply because it is there does not assure effective learning. Technology must be a means – not the aim. More important are the pedagogical considerations and the ways of using the technology to extract more of the pedagogical benefits.

The technology should be used to drive active learning, give immediate feedback, and present external and internal multiple representations in multimedia learning. In using discussion groups, other interactive features, and inquiry-based approaches, teachers can nurture a learning environment that enables students to create their own meaning, and organize and rationalize their personal experiences. Examining experience fosters learning (Fosnot, 1996). Technology should be used to serve pedagogical needs and to enable meaningful learning.

Many examples exist to guide instructors in the design of more innovative and dynamic course web sites. Yet, there is still a tendency for instructors in engineering education to build course web sites that underutilize the technology's potential. This tendency can be seen to stem from difficulties that teachers face in moving from teacher-centered to resource-based learning (Oliver & McLoughlin, 1999). While motivational issues should be taken into consideration, teacher should use technology for creating a learning environment that assures: "Overall, students find electronic interaction a meaningful, enjoyable experience" (LaMaster & Morley, 1999).

References

Bhattacharya, M. (1999). A study of asynchronous and synchronous discussion on cognitive maps in a distributed learning environment. *Proceedings of the WEBNET 99 World Conference on the WWW and Internet.* Honolulu, Hawaii, October 24-30.

Black, P., & Wiliam, D. (1998). Inside the black box: Raising standards through classroom assessment. *Phi Delta Kappan, 80* (2), 139-144.

Branon, R. F., & Essex, C. (2001). Synchronous and asynchronous communication tools in distance education. *TechTrends. 45* (1), 36-42.

Brown, B.L. (2000). *Web-Based-Training*. Washington, DC: Office of Educational Research and Improvements. (ERIC Document Reproduction Service No. EDO-CE-00-218).

Burgess, L. A. (2003). WebCT as an e-learning tool: A study of technology students' perceptions. Journal of Technology Education, 15 *(1), 6-15.*

Cobern, W. (1993). Contextual constructivism: The impact of culture on the learning and teaching of science. In K. G. Tobin (Ed.), *The practice of constructivism in science education.* Hillsdale, NJ: Lawrence Erlbaum Associates.

Cronbach, L. J. (1977). *Educational psychology.* New York: Harcourt Brace Jovanovich.

Crooks, T. J. (1988). The impact of classroom evaluation practices on students. *Review of Educational Research, 58* (4), 438-481.

Dehoney, J., & Reeves, T. (1999). Instructional and social dimensions of class web pages. *Journal of Computing in Higher Education, 10* (2), 19-41.

Early, P. C. (1988). Computer-generated performance feedback in the magazine-subscription industry, *Organizational Behavior and Human Decision Processes*, *41*, 50-64.

Frank, M., Reich, N., & Humphreys, K. (2002). Respecting the human needs of students in the development of e-learning. *Computers & Education, 40* (1), 57-70.

Glasersfeld, E.V. (1995). A constructivist approach to teaching. In P. Leslie, & J. Gale (Eds.), *Constructivism in education*. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics*, *66* (1), 64-74.

Hativa, N. (2000). *Teaching for effective learning in higher education.* Dordrecht, The Netherlands: Kluwer Academic Publishers.

Hill, A. M. (1997). Reconstructionism in technology education. *International Journal of Technology and Design Education, 7* (1-2), 121-139.

Hill, J. R. (1997). Distance learning environments via the world wide web. In H. K. Badrul (Ed.), *Web-based instruction.* Englewood Cliffs NJ: Educational Technology Publications.

Jackson, B. (1988). A comparison between computer-based and traditional assessment tests, and their effects on pupil learning and scoring. *School Science Review, 69*, 809-815.

Kluger, A.N., & DeNisi, A. (1996). The effects of feedback interventions on performance: A historical review, a meta-analysis and preliminary feedback theory. *Psychological Bulletin, 119,* 254-284.

Kozma, R. (2003). The material features of multiple representations and their cognitive and social affordances for science understanding. *Learning and Instruction: The Journal of the European Association for Research on Learning and Instruction*, *13* (2), 205-226.

Krajcik, J., Czerniak, C., & Berger, C. (1999). *Teaching children Science: A project-based approach.* New York: McGraw-Hill College.

Kumar, D. D., & Helgeson, S. L. (2000). Effect of gender on computer-based chemistry problem solving. *Electronic Journal of Science Education. 4* (4), Retrieved July 12, 2004, from http://unr.edu/homepage/crowther/ejse/kumaretal.html

LaMaster, K. J., & Morley, L. (1999). Using *WebCT bulletin board option to extend transitional classroom walls.* (ERIC Reproduction Service No ED 440 922).

Lewalter, D. (2003). Cognitive strategies for learning from static and dynamic visuals. *Learning and Instruction: The Journal of the European Association for Research on Learning and Instruction*, *13* (2), 177-190.

Lister, B. C. et al. (1999). The Rensselaer 80/20 model for interactive distance learning. *Proceedings of Educause 99.* Long Beach, CA, October 26-29. Retrieved July 12, 2004, from http://www.educause.edu/ir/library/html/edu9907/edu9907.html

Locke, E. A., & Latham, P.L. (1990). *A theory of goal setting and task performance.* Englewood Cliffs, NJ: Prentice-Hall.

Lowe, R. K. (2003). Animation and learning: selective processing of information in dynamic graphics. *Learning and Instruction: The Journal of the European Association for Research on Learning and Instruction*, *13* (2), 157-176.

Mayer, R. E. (2003). The promise of multimedia learning: using the same instructional design methods across different media. *Learning and Instruction: The Journal of the European Association for Research on Learning and Instruction*, *13* (2), 125-140.

Natriello, G. (1987). *Evaluation processes in schools and classrooms*. Baltimore, MD: Johns Hopkins University, Center for Social Organization of Schools.

Oliver, R., & McLoughlin, C. (1999). Curriculum and learning-resources issues arising from the use of web-based course support systems. International Journal of Educational Telecommunications, 5*(4), 419-435.*

Schnotz, W., & Bannert, M. (2003). Construction and interference in learning from multiple representations. *Learning and Instruction: The Journal of the European Association for Research on Learning and Instruction*, *13* (2), 141-156.

Schnotz, W., & Lowe, R. (2003) Introduction. *Learning and Instruction: The Journal of the European Association for Research on Learning and Instruction*, *13* (2), 117-124.

Vygotsky, L. S. (1986). *Thought and language*. Translated by A. Kozulin. Cambridge, Mass: MIT Press. (Original English translation published 1962.)

Willis, B., & Dickinson J. (1997). Distance education and the world wide web. In H. H. Badrul (Ed.), *Web based instruction.* Englewood Cliffs. NJ: Educational Technology Publication.

Wiliam, D. (2002). Notes towards a theory of formative assessment. *Paper presented at the joint Northumbria/EARLI assessment conference: Learning communities and assessment cultures, connecting research with practice.* Newcastle, UK, 28-30 August.

Wolcott, L. (1995). The distance teacher as reflective practitioner. *Education in Technology, 34* (3), 49-55.

About the Authors

Dr. Moti Frank is the head of the Center for the Advancement of Teaching at the Technion – Israel Institute of Technology and a senior lecturer in the Department of Education in Technology and Science. His research interests are Educational Technology; E-Learning; Computers in Education, Systems Thinking, and Engineering Education.

Mailing address: Center for the Advancement of Teaching, Ullmann building, Technion – Israel Institute of Technology, Technion city, Haifa 32000, Israel.

Phone (office): +972-4-8293212 Email: frankm@tx.technion.ac.il

Dr. Abigail Barzilai is a teaching consultant for faculty staff in the Center for the Advancement of Teaching at the Technion – Israel Institute of Technology and an adjacent lecturer in the Department of Education in Technology and Science. Her research interests are Higher Education, E-Learning, and Biology Teaching.

Mailing address: Center for the Advancement of Teaching, Ullmann building, Technion – Israel Institute of Technology, Technion city, Haifa 32000, Israel.

Phone (office): +972-4-8292275 Email: abigailb@tx.technion.ac.il

Note: As Guest Editor for the December International Journal, Brent continues to write his regular articles for scholars and students. There is no greater joy than to see a student take adopt and apply what he or she learns in an innovative or creative way. Too much education is filling a template set by the instructor. Brent gives us some clues to help the online student break "out-of-the-box!"

Encouraging Creativity in Student Online Work

Brent Muirhead

"Go confidently in the direction of your dreams. Live the life you have imagined."

Henry David Thoreau (American essayist, poet and philosopher, 1817-1862)

Introduction

Educational and business literature affirms the importance and value of creativity. Unfortunately, this knowledge is not always presented in a manner that is useful to online instructors who want to integrate more reflective lessons into their courses. The discussion will provide vital background information on creativity and offer relevant instructional suggestions to promote creativity in online classes.

What is Creativity?

The term creativity can be an illusive term to define because writers do not want to undermine or diminish the positive aspects that are often associated with the word. For instance, if someone relates that they consider you a creative person, it is considered a compliment and an affirmation of your abilities. A survey of definitions of creativity highlights the intriguing qualities of this term. Harris (1998) provides one of the best descriptions of creativity:

- **An Ability**: A simple definition is that creativity is the ability to imagine or invent something new.
- **An Attitude:** Creativity is also an attitude: the attitude to accept change and newness, a willingness to play with ideas and possibilities, a flexibility of outlook, the habit of enjoying the good, while looking for ways to improve it.
- **A Process**: Creative people work hard and continually to improve ideas and solutions, by making gradual alternations and refinements to their works (para 2, 4 & 5).

The description highlights the multidimensional nature of creativity while stressing that individuals must realize that it involves hard work and a flexible mental attitude. There seems to be some misconception about the need for hard work but it is affirmed by today's writers. Howe (1999) has conducted a biographical analysis of people who were considered in the category of being a genius (i.e. Einstein) due to their exceptional work. A detailed historical examination of their lives has shown that most were characterized by having a tremendous work ethic. This enabled them to have the diligence and patience to use problem solving techniques to reach brilliant solutions with their ideas.

Online instructors want their students to demonstrate fresh ideas and perspectives in their written assignments, essay exams, online discussions, Power Point Presentations and learning team projects. Students who participate in stimulating instructional activities will be encouraged to cultivate their imaginations and it should be one of the trademarks of a good education. Instructors must work with individuals who come from cultures that sometimes undermine critical thinking and self-directed learning. White (2003) argues that Americans have settled for a

superficial creativity built upon passively observing others display their imaginations in the entertainment industry. Business leaders have managed creativity into neat film or television show formulas that are financially profitable but fail to intellectually challenge people to be truly reflective and autonomous thinkers. “The culture informed by the strategies of the Middle Mind promises intelligence, seriousness, care, but what it provides in reality is something other. What the Middle Mind does is flatten distinctions. It turns culture into mush” (White, 2003, p. 10).

Teaching Philosophy and Strategies

Instructors can promote creativity by developing course materials and activities that reinforce reflective skills. Recently, educators have stressed the importance of metacognition which Livingston (1997) defined as “thinking about thinking” (para 2). The word relates to a form of self regulation or executive control of the cognitive processes. Flavell (1979) has described metacognition in terms of three basic categories: individual knowledge about learning, knowledge of variables to complete a task and knowledge strategies. Metacognition skills play a vital role in a student’s ability to succeed in higher education and being able to resolve daily problems or issues in their future jobs. Students must make a diversity of learning decisions based on their understanding of their skills and study habits. For instance, an individual might select a library over a university dorm room as being the best place to be effectively study and prepare for an exam (Livingston, 1997).

Metacognition is closely connected to critical thinking because both involve self-regulating activities. Lipman (1995) states “….critical thinking is skillful, responsible thinking that facilitates good judgment because it (1) relies upon criteria, (2) is self-correcting, and (3) is sensitive to context” (p. 146). The definition reveals the dynamic nature of critical thinking and perhaps why it is not always being taught in our traditional and online universities. The author has completed six graduate degree programs and sadly some of my course work involved tedious rote memory work for essay exams. There is a place for knowing basic knowledge in every academic discipline. Educators must make a deliberate effort to have learning objectives and instructional activities that address foundational knowledge while providing adequate opportunities for reflective thinking.

Teachers who want to enhance the teaching and learning process realize that fostering critical thinking skills will require extra work to effectively communicate complex ideas to their students. Bullen’s research (1998) reveals that a student’s ability to demonstrate critical thinking skills during online discussions is influenced by four major factors: cognitive maturity, teaching style of instructor, student’s prior learning experiences and degree of understanding the critical thinking process. The factors reveal that students will vary in their understanding of critical thinking skills and cognitive abilities. Therefore, teachers will need to develop a set of instructional strategies that will help them to meet a diversity of student needs. It is important for teachers to provide a rich intellectual environment that helps to eliminate myths about creativity. Teresa Amabile who heads the Entrepreneurial Management Unit at Harvard University conducted a research project on creativity. Amabile’s team collected information from 238 individuals involving almost 12,000 daily journals comments who were working on projects from seven different companies. Breen (2004, pp.75-78) relates how Amabile’s research study has identified six myths about creativity:

1. Creativity comes from creative types: Creativity depends upon a number of things; experience, including knowledge and technical skills; talent; an ability to think in ways; and the capacity to push through uncreative dry spells.
2. Money is a creativity motivator: People are most creative when they care about their work and they’re stretching their skills.

3. Time pressure fuels creativity: Time pressure stifles creativity because people can't deeply engage with the problem.
4. Fear forces breakthroughs: We found that creativity is positively associated with joy and love and negatively with anger, fear, and anxiety.
5. Competition beats collaboration: In our surveys we found that creativity takes a hit when people in a group compete instead of collaborate.
6. A streamlined organization is a creative organization: Creativity suffers greatly during downsizing. Every single one of the stimulants to creativity in the work environment went down significantly.

The research study highlights the complexity associated with cultivating creativity into work and educational settings. A major educational problem involves how to effectively promote and sustain student creativity in the online environment. As a mentor of faculty candidates at the University of Phoenix, some instructors will verbalize their belief in a student-centered teaching philosophy. Yet, their actual online presence is one of dominating the student dialog with an excessive number of daily comments. The negative facilitator practice can diminish the quality of the discussions as students become reluctant to express their ideas which seem less important than the instructor's.

Encouraging student creativity will require providing specific instruction on reflective thinking by helping students to understand the nature of critical thinking. The teaching of critical thinking should be considered as a normal part of the curriculum and should be integrated in some manner into every subject area. Also, teachers must offer clear and detailed instructions in their assignments while creating an open ended dimension for the exploration of ideas. The instructions are essential because even graduate level students need guidance and student must feel secure in the evaluation and grading process to become risk takers in their work. The author recalls approaching a doctoral teacher about taking a class in the independent study format without having to attend the traditional face-to-face classes. The teacher agreed to the proposal and the course syllabus was adjusted to the following requirements: read 8 books and write 11 papers! The author completed the work and asked the teacher why so much work was assigned and the teacher responded by noting "it was to make up for lost seat time." The incident is a good reminder that teachers and students must work together to foster positive learning experiences.

Teachers should communicate a picture of a creative thinker through their teaching style, sharing stories of innovative individuals and demonstrating novel ideas through the use of charts, lectures and Power Point Presentations. Brookfield's (1987, pp. 115-116) characteristics of a critical thinker are informative about understanding the illusive process of understanding how people become creative:

- Creative thinkers reject standardized formats for problem solving.
- They have interests in a wide range of related and divergent fields.
- They can take multiple perspectives on a problem.
- They view the world as relative and contextual rather that universal and absolute.
- They frequently use trial-and-error methods in their experimentation with alternative approaches.
- They have a future orientation; change is embraced optimistically as a valuable possibility.
- They have self-confidence and trust in their own judgment.

Distance educators could learn valuable lessons about encouraging creativity from today's business organizations. Gore-Tex fabrics is a superb example of an innovative major corporation which has over 63,000 employees and $1.5 billion in annual revenues. W. L. Gore has developed a thriving organizational culture which emphasizes small teams, cutting edge products and leaders who regularly devote time to speculative thinking. The company has experienced continuous product breakthroughs which reflect a business built on long term goals. Gore's leadership philosophy and work rituals are designed to affirm creativity. Deutschman (2004) observes that the teams will celebrate both project successes and failures. Why do they celebrate a failure? It is an intentional way to affirm that risk takers are always honored in their endeavors. Perhaps, a missing ingredient in today's online degree programs is the absence of adequate number of student risk taking opportunities. Teachers and students must be given enough freedom to pursue imaginative and valuable work that sometimes transcends the normal curriculum.

Teachers will need to develop a class structure and online teaching style that encourages creativity, reflective thinking, and self-directed learning. It is important that teachers enable students to have the freedom to ask questions and take intellectual risks in their written assignments and discussion groups. Teachers can provide valuable guidance by keeping dialogues focused, relevant and probing deeper into issues. This will require moderating discussions and creating a list of key ideas, references and student contributions. Distance educators can pose a diversity of questions to foster reflective comments. Collision, Elbaum, Havvind & Tinker (2000) have created five types of questions to encourage richer student responses that are called full-spectrum questions:

- Questions that probe the "so what!" response- relevance, interest level, urgency and context
- Questions that clarify meaning or conceptual vocabulary- ambiguity or vagueness and common concepts
- Questions that explore assumptions, sources and rationale- qualities assumed and study evidence
- Questions that seek to identify causes and effects or outcomes-primary or secondary and causes, internal or external factors
- Questions that consider appropriate action- weigh different courses of action (p. 143).

Teachers should view the full-spectrum questions as a tool for enhancing dialog. The choice of questions can be used to guide the discussion and help energize online interaction. It is wise not to overuse a particular question approach because students will begin to lose interest if the process becomes too predictable or even annoying. For instance, instructors who frequently respond to a student's comments with a question are guilty of over using a learning strategy. Also, it can annoy students who want more in-depth interaction over their ideas. Instructors can spark a lively dialog by using quotes, pictures, cartoons, simulations or graphics at different times during the course. A thought provoking quote can stimulate discussion and breathe new life into an apparently stale topic.

Teachers and students are confused about what constitutes genuine reflective thinking and that complicates efforts to integrate it into the curriculum. Woolfolk's (1990) chart helps to clarify what are some of the major elements in the critical thinking process:

Defining and clarifying the Problem

Identify central issues or problems.

Compare similarities and differences.

Determine which information is relevant.

Formulate appropriate questions.

Judging Information Related to the Problem

Distinguish among fact, opinion, and reasoned judgment.

Check consistency.

Identify unstated assumptions.

Recognize stereotypes and clichés.

Recognize bias, emotional factors, propaganda, and semantic slanting.

Recognize different value systems and ideologies.

Solving Problems/Drawing Conclusions

Recognize the adequacy of data.

Predict probable consequences (p. 278).

Figure 1: Woolfolk's chart of Major Elements in the Critical Thinking Process

The chart can seem a bit overwhelming to educators who want to include higher order thinking in their instructional plans. It is important to recall that the essence of critical thinking is making good judgments which includes having criteria, self-correcting procedures, and being aware of context (Brookfield, 1987). The chart offers an excellent resource to create lesson plans and discussion questions that support higher order skills and creativity.

Conclusion

The discussion has briefly explored helping students to be creative in their online class work. There is a degree of mystery associated with the subject of creativity that challenges educators to continue studying how individuals translate their imaginations and ideas into innovative products. It is a vital educational issue that holds the promise of enriching student learning experiences as students become more effective at utilizing their cognitive skills and knowledge.

References

Breen, B. (2004, December) The 6 myths of creativity. *Fast Company*, 75-78.

Brookfield, S. D. (1987). *Developing Critical thinkers: Challenging adults to explore alternative ways of thinking and acting.* San Francisco: Jossey-Bass.

Bullen, M. (1998). Participation and critical thinking in online university distance education. *Journal of Distance Education*. 13 (2).Available: http://cade.icaap.org/vol13.2/bullen.html

Collison, G. Elbaum, B., Haavind, S., & Tinker, R. (2000). *Facilitating online learning: Effective strategies for moderators.* Madison, WI: Atwood Publishing.

Deutschman, A. (2004, December). The fabric of creativity. *Fast Company,* 54-62.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. *American Psychologist*, 34, 906-911.

Harris, R. (1998). Introduction to creative thinking. Available: http://www.virtualsalt.com/crebook1.htm

Howe, M. J. A. (1999). *Genius explained.* Cambridge, England: Cambridge University Press.

Lipman, M. (1995). Critical thinking - what can it be? In A. L. Ornstein & L. S. Behar (Eds.) *Contemporary Issues in Curriculum*, Boston, MA: Allyn & Bacon, 145-152.

Livingston, J. (1997). Metacognition: An overview. Available: http://www.gse.buffalo.edu/fas/shuell/cep564/Metacog.htm

Thoreau, H. D. (n.d.). Quote. Available: http://en.thinkexist.com/

White, C. (2003). *The middle mind: Why Americans don't think for themselves*. San Francisco, CA: HarperCollins.

Woolfolk A. E. (1990). *Educational psychology* (4th ed.). Englewood Cliffs, NJ: Prentice Hall.

About the Author

Brent Muirhead Ph.D.

Brent Muirhead has a BA in social work, master's degrees in religious education, history, administration and e-learning and doctoral degrees in Education (D.Min. and Ph.D.).

Dr. Muirhead is the Lead Faculty and Area Chair for GBAM Business Communications in the graduate department at the University of Phoenix campus in Atlanta, Georgia. He teaches a diversity of undergraduate and graduate level courses in Atlanta and online. He is an Associate Editor for Educational Technology and Society and he has worked as a visiting research fellow to Robert Gordon University, Aberdeen, Scotland.

He may be reached via email at: bmuirhead@email.uophx.edu.

Editor's Note: Book reviews are helpful for those who make decisions for selecting course textbooks or seek a guide for their professional reading. Muhammad Betz provides a relevant and scholarly review on a recent book in distance education.

Distance Education: A Systems View

A Book Review by Muhammad K. Betz

Book Details

Distance Education: A Systems View, 2nd edition
Michael Moore and Greg Kearsley
Thomson/Wadsworth
xxii + 368 pages Year 2005
ISBN 0-534-50688-7

Make no mistake about it, this book is a text book, and unlike its preceding first edition published in 1996, this second edition is but one text book on the topic of Distance Education among many available in the year 2005. Other recent texts on this topic include: *Teaching and Learning at a Distance: Foundations of Distance Education* by Michael Simonson, Sharon Smaldino, Michael Albright, and Susan Zvacek (2003); and *Online Learning: Concepts, Strategies, and Applications* by Nada Dabbagh and Brenda Bannan-Ritland (2005). These three textbooks have similar looking Tables of Contents (see Figure 1, Tables of Contents from Three Related Texts).

Table 1

Tables of Contents from Three Related Texts

Teaching and Learning at a Distance: Foundations of Distance Education, Simonson, et al.	*Online Learning: Concepts, Strategies, and Applications*, Dabbagh, et al.	*Distance Education: A Systems View, 2nd edition*, Moore & Kearsley
Foundations of Distance Education (DE)	What is Online Learning (OL)?	Basic Concepts
Definitions, History, Theories of DE	Roles and Competencies of Online Learner & Instructor	Historical Context
Research and DE	Research on OL	Scope of DE
DE Technologies	Integrative Learning Design Framework for OL	Technologies and Media
Copyright and DE	Constructivist Models OL	Course Design & Development
DE Student	Instructional Strategies, Authentic Learning & OL	Teaching & Roles of Instructor
Teaching at Distance	Evaluation of OL	The DE Student
Handouts, Study Guides, Visuals	Authoring Tools: Paradigms, Usage, Implications	Management, Administration, Policy
DE, the WWW, and Internet	Course Management Systems	Theory & Scholarship of DE
Assessing for DE		Research and Studies of Effectiveness
Evaluating Teaching/Learning at Distance		Global Span of DE
		DE Is About Change

In analyzing the list of topics covered by these three text books, *Distance Education: A Systems View, 2nd Edition*, differs in three areas: Course Design and Development; Management, Administration, and Policy; and The Global Span of Distance Education.

Clearly, this text by Michael Moore and Greg Kearsley reflects the perspective of reputable educators who are "hands-on" practitioners of distance education efforts.

The Chapters

The authors establish two central themes for the entire text in Chapter 1, Basic Concepts. First, they introduce the concept of a systems view of distance education. Anyone with an advanced degree in educational or instructional technology can appreciate the fidelity of that emphasis. This field derives from and is built upon the bedrock of a systemic view of educational processes. The second motif addressed in Chapter 1 is that distance education is a changing paradigm, one that is perpetually evolving, non-static, and dynamic. In a word, Distance Education is seen as a vital enterprise.

Chapter two reviews the historical development of distance education in succinct fashion. The authors identify five generations of DE: correspondence/home, broadcast radio/television, open universities using combined approaches, interactive teleconferencing, and the current generation of online-based classes. The value of this chapter lies in its conceptual clarity and accuracy.

The third chapter, The Scope of Distance Education, describes the many current forms of DE in the United States and summarizes the main characteristics of them. The identified list of DE formats include: home study, independent study, open universities, interactive television, and online learning. This text clarifies how these forms are relevant at present, thus avoiding the errors of other texts which have a tendency to stray outside of temporal realties, mixing the past and the present in irrelevant ways.

Selection of media or channels of communication for the delivery of education at a distance is the focus of Chapter Four, Technologies and Media. The authors note that there is not a definitively correct technology for DE, but credit print technologies as the most common, noting different print formats and their limitations. It is suggested that the selection of media should be done based upon a systemic view of DE, while emphasizing a preference for multiple media formats based upon analyses of audience, content and design considerations.

Chapter 5, Course Design and Development is a break-away chapter for this text. In it, the authors show their combined strengths as premier educators in the field. They steer the conceptual view of Distance Education to the tried and true modus operandi of Instructional Systems Design. This chapter serves as comprehensive, practical guide for creating and conducting a DE class, in different media formats.

In Chapter 6, Teaching and the Roles of the Instructor, the authors introduce and explain how DE changes the traditional roles of the instructor. It explores the social context of online learning and considerations of examination security, for example. Quality training for distance teaching is recommended to include: hands-on practice with the technologies; practice for humanizing a DE course; and practice for facilitating student interaction in the distance mode.

The seventh chapter, The Distance Education Student, emphasizes the probability that distance learners are more likely to be adult learners, while focusing on theme of ensuring student success and completion. The distance student is considered from the point of view of relevant research on attitudes and support needs, with the authors identifying the five critical points of support: orientation and admissions; ongoing assistance; study skills; problem solving; and peer relations.

Chapter 8, Management, Administration, and Policy, showcases another strength of the authors' experience-based expertise in providing a step-by-step protocol for conducting DE, from a managerial point of view. The topics of strategic planning, staffing, administrative issues, and quality assurance are addressed as practical matters warranting clear strategies. Further, the topics of policies and their influences on DE are considered. Throughout this chapter the authors successfully tie theoretical points to real world situations.

The next two chapters, Chapter 9, The Theory and Scholarship of Distance Education, and Chapter 10, Research and Studies of Effectiveness, are more traditional chapters in such textbooks. They are nonetheless well written and full of valuable information. There is present in these chapters an overarching strategy for the presentation of theories and research that is consistent with the systems view of DE and the goal of optimizing its practical application. The chapter of research revisits the conceptual vantage points introduced in previous chapters and identifies pertinent research efforts that indicate best practices.

In the eleventh chapter, The Global Span of Distance Education, the authors impress upon the readers that DE is everywhere! While stating that DE is present in some form in almost every country, this text issues a caveat related to the glaring discrepancies between technological have and have-not countries. Regardless, this global account provides an accurate report of the various efforts in DE based upon major, geographical regions of the world, emphasizing the genuine importance of developing a world view of DE.

The last chapter, Distance Education Is about Change, reinforces the major motif that DE today is not the same as DE was in the past or what it will be in the future. Changes in information and technology are highlighted as the primary driving forces for perpetual change in the field. Further, evolving organizational structures and threats of commercial denigrations are discussed.

In Sum

This text is excellent in that it relates a contemporary view of Distance Education to Instructional Systems Design. It is in some ways a manual for creating and administering DE courses with an important element of academic integrity evidenced throughout. The authors' reputations and are fully realized in this effort.

References

Dabbagh, N., & Bannan-Ritland, B. (2005). *Online learning: Concepts, strategies, and application.* Pearson Merrill Prentice Hall. Pp. xix + 348.

Moore, M., & Kearsely, G. (2005). *Distance education: A systems view, 2nd edition.* Thomson/Wadsworth. Pp. xxii + 368.

Simonson, M., Smaldino, S., Albright, M., & Zvacek, S. (2003). *Teaching and learning at a distance: Foundations of distance education, second edition.* Merrill Prentice Hall. Pp. xvii + 302.

About the Reviewer

Muhammad K. Betz

Muhammad K. Betz is Professor and Departmental Chair of Educational Instruction and Leadership at Southeastern Oklahoma State University. He is also a member of the Faculty and a Faculty Mentor at the University of Phoenix Online, where he has taught and/or mentored over one hundred online courses for graduate credit. His degrees in field are: B.S., Ball State University; M. Ed. and Ph.D., University of Texas-Austin.

His specialty areas include Instructional Technology, Curriculum and Instruction, and Teacher Education.

Email: mbetz@sosu.edu