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Preparing Teachers For Assistive Technology Using Online Learning: A Descriptive Study

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Abstract

This paper describes the learning environment of the introductory courses provided as part of the Virtual Assistive Technology University (VATU) certificate in assistive technology for educators. VATU, sponsored by The Spurwink Institute and the University of Southern Maine, offered its first course in the spring of 2001. The Web-based courses in this certificate program provide special and general educators with the knowledge and skills necessary to incorporate assistive technology in their educational programs for students with disabilities. This paper provides an in-depth descriptive study of the rationale of strategies for embedding social learning in the first two VATU courses. As each of the seven courses is delivered, assessment of student learning and student and instructor feedback and reflection will guide the course developers and instructors in improving the effectiveness of social learning.

Research has estimated that, "in 1998, 6-13% of college students identified themselves as being disabled, almost a triple increase over the past decade." (Kim-Rupnow, Dowrick, & Burke, 2001). In addition, it is now required that assistive technology be considered in the development of Individual Education Programs (IEP) for students with disabilities. This dramatic increase underscores the need for P-12 schools and postsecondary institutions to improve accommodations and access for children and youth ages 3 through 21. In the realm of education, this means providing training for educators who are in contact with these individuals on a day-to-day basis. This makes it necessary to provide quality professional development in the area of assistive technology to P-16 general and special educators. The Virtual Assistive Technology University (VATU) is using highly interactive Web-based courses and online resources that carry graduate credit through the Professional Development Center at the University of Southern Maine. By offering the courses online, VATU hopes to make a substantial impact in the preparation of educators to integrate and use assistive technology, specialized software, Web accessibility and universally designed curriculum. The online asynchronous mode of course presentation for educators currently working in the field, seems to fit well with the current research in distance learning which states that "working at one's own

pace meets the needs of adult learners, who usually have schedule and career concerns" (Smith 2001). Not included in this statement are the family concerns that also effect many of the educators currently working in the field. The Web-based nature of the courses also allows the instructor to bring together a "critical mass" of participants without the need for extended travel, which is a concern for the educators located in the rural areas of the country.

Analysis of Current Programs

The Rehabilitation Engineering and Assistive Technology of North America (RESNA) lists only 21 training programs in the U.S. that offer courses, degrees, and/or certificates in engineering and assistive technology. Of these 21 programs, few provide a comprehensive program on educational assistive technology applications, including accommodating students in the general curriculum. None of the programs provides concurrent, integrated training in educational applications of assistive technology, specialized software Web accessibility, or universally designed curriculum. Two programs have a national focus. The Center on Disabilities at California State University, Northridge (CSUN) offers an Assistive Technology Applications Certificate Program (ATACP). This 100-hour program focuses on assistive technology for persons with disabilities, but only a small part of the program deals with educational applications. The Research Institute for Assistive and Training Technologies at the National Association of State Directors of Special Education (RIATT@NASDSE) is another certificate program for educators, occupational therapists, and other professionals working with assistive technology. Only a small segment of the training in these programs focuses on educational applications of assistive technology. Although both provide much needed training in assistive technology, there is a scarcity of training programs emphasizing assistive technology in education and specialized software, Web accessibility, or universally designed curriculum.

Research on Online Communities

The use of electronic learning in the certificate reflects both the desire to use the electronic medium that is the focus of the training and to join together educators from various locations with different schedules and work responsibilities. The proliferation of electronic learning, represented primarily by Web-based materials, has sparked renewed interest in what comprises quality instruction for school-age students and for students in higher education. The literature provides an emerging picture of how online learning communities, highly interactive Web-based instruction, and online resources can support learning for understanding. For example, the text *Web-Based Instruction* (Khan, 1997) suggests that the interactive nature of the Internet promotes learning, instruction, and collaboration. An article titled "Collaborative Classrooms" (Goldsworthy, 1999) identifies ways in which collaboration is fostered using the Internet. The book *Virtual Sandcastles: Teaching and Learning at a Distance* (Lamb & Smith, 1999) describes how distance learning can be implemented and managed. Thomas Russell, in his book *The No Significant Difference Phenomenon*, reports on over 300 research articles, and papers that conclude that the difference in effects of electronic teaching as compared to face-to-face teaching, are negligible. These findings can be interpreted in several

ways. One can propose not to engage in electronic learning if there is no difference, if it is no better. One can also propose that this is a positive finding supporting continuing the exploration of electronic learning. If it is not worse, then efforts to continue to improve teaching and learning through electronic media should continue. Joy and Garcia (2000), conclude that much of the comparative research is misdirected by examining technology versus no technology, rather than how technology can support effective instructional design strategies. Hiltz et al. (2000), of the Asynchronous Learning Network (ALN), suggest an alternative question, which is "How can ALN and other technologies best be used to improve the effectiveness of educational delivery?" This includes access, efficiency (cost in time and money), as well as learning outcomes (p. 2). Hiltz et al. undertook to apply this suggestion to their own program at the New Jersey Institute of Technology. Fredericksen, Pickett, and Shea (2000) applied it to the State University of New York Learning Network, an online instructional program including 64 colleges and nearly 400,000 students of the SUNY System. This study is the beginning of a multi-year effort to apply principles of effective learning and teaching in the design, delivery, and assessment of Web-based instruction for assistive technology.

Social Learning

Before attempting to make a meaningful analysis of the courses and how they may benefit the intended audience, it is important to gain some insight into the theoretical frameworks that guide the structure of these courses. An interview was conducted with the course design team leader to gain insight into the development of the structure of the introductory courses. According to the design team leader, the key factor in the development of the online courses is to provide an environment in which the learners are supported, and are communicating and interacting with each other online. The reason for this is twofold: first, to eliminate the feeling of isolation that online courses may give some participants, and second, to realize the benefits of social interaction in the process of learning.

It is the feeling of the developer that the majority of participants in this series of courses will be from a generation that has not grown up with computers. These participants are more accustomed to face-to-face interactions when they are attempting to have an enlightening discussion requiring deep thought and understanding. For this group of people, sitting in front of the video display terminal of a computer, instead of being a connecting experience as it is to many of the generation of young adults who have grown up with e-mail and instant messaging, is an isolating experience that just serves to make them feel overall disconnected from the rest of the class participants. The majority of educational experiences for this group of individual learners has been to have face-to-face contact with their fellow students and also to have the instructor immediately available to provide feedback for their questions or problems.

An important goal of the VATU instructors is to build an interactive component so that participants engage in "conversations" through the use of discussion boards, e-mail, and group projects. The courses are designed to support the learner in knowing that there are opportunities for them to communicate with their fellow students and the instructor. Research has shown that online discussions can be an effective way for students to share their learning fears and strategies. One study asserts however, that in order to promote an effective learning

environment the instructor needs to provide guidelines for the online interactions (Morrison & Guenther, 2000). Morrison and Guenther (2000) suggest that the guidelines need to support how to use the technology, sustain different levels of student participation, and foster student involvement. It was further suggested that the professor should provide a need for frequent participation by posting questions requiring student input. The VATU course design encourages the participants to communicate and interact with each other through the use of discussion boards and e-mail. Asynchronous interaction has several advantages that the VATU course designers wished to incorporate.

- Flexible and accessible at any time
- Allows students time to reflect
- Lends itself to a situated learning approach (Berge, 2000)

For example, student led discussions are included throughout the course. The guidelines for student led discussions are:

> The questions you ask should be thoughtfully developed, carefully worded, and address issues or concepts from the material that you found interesting/important/provocative. I will use the following criteria to evaluate your questions:
>
> Relevance—Your question must be relevant to the material in the module of study.
>
> Importance—Your question must address a significant issue in the module.
>
> Originality—You must ask a question that is not essentially the same as one posed by another student.
>
> Timeliness—Your question must be posted early enough in the module to allow other students adequate time to respond and to allow development of a good discussion thread.
>
> Thought-Provoking—Your questions must require high-level thought, not a simple "look-up" in the reading/video.
>
> Remember—You must lead one discussion and you must reply to other students who answer questions you submit. You are in control of the quality of the thread you create, so be sure to give feedback. If students post high quality responses, tell them.
>
> In order to start an original student-led discussion, go to the Discussion Board and enter the forum titled "Student-Led Discussion" for the week you have been assigned. Click on "Add New Thread" and then simply type your message. If you wish to ask a question that will lead an already-existing discussion in a new direction, make sure to reference the already-existing discussion in your post. Both of these are acceptable options.

An Asynchronous Learning Network represents several qualities of effective teaching and learning that were integral to the success of the VATU courses. ALNs are "groups of people who use computer-mediated communication networks to learn together, at the time, places, and pace that best suit them…" (Hiltz et al., 2000, p.2). One principle represented in this definition is "the fact that robust knowledge and understandings are socially constructed through talk, activity, and interaction (Vygotsky, 1978)" (Bransford, Brown, & Cocking, 2000, p. 184). A second principle represented in this definition is that understanding and skill are constructed by the individual, not deposited by an instructor or print or media package. The individual must interact and grapple with the idea or skill, not passively serve as a receptacle for transmitted information. As stated by Bransford, Brown, and Cocking (2000), "Learner centered environments include teachers who are aware that learners construct their own meanings, beginning with the beliefs, understandings, and cultural practices they bring to the classroom" (p. 136).

The Current Study

This paper reports an in-depth descriptive study of the VATU introductory Web-based courses, their design framework and pedagogical foundations. This paper describes the strategies intended to promote exchange of ideas and information between students, for example, the nature of the discussions that took place during the courses' threaded discussion board interactions and the completion of group projects.

Methodology

A descriptive process evaluation study was conducted to elaborate on the nature of the environment that was created for the introductory online courses. Process evaluation studies attempt to "elucidate and understand the internal dynamics" of, in this case, an online learning environment (Patton, 1990). According to Patten, process evaluation studies are especially useful to answer questions such as "What are the things people experience that make this program what it is?" (p. 95). For the purpose of building a rich description of the online environment of these courses, the discussion strands throughout the 2001 fall semester were saved and analyzed for their contributions to the conceptual nature of the strand topic. The students were provided with a rubric describing how the instructors would evaluate the nature of their discussions to be used for part of their course grade. The rubric evaluated aspects of the discussions such as:

Relevance—the discussion must be relevant to the material in the module of study.

Importance—the discussion must address a significant issue in the module.

Originality—the discussion must not be essentially the same as one posed by another student.

Timeliness—the discussion must be posted early enough in the module to allow other students adequate time to respond and to allow development of a good discussion thread.

This same rubric was used by the researchers to evaluate the conceptual contribution each student entry made to the discussion strand. Because the nature of these discussions was central to the building of the online environment, they provided the most important data source for this study. A second data source used to further understand the intended design of the course were interviews conducted with the curriculum designers, as well as general discussions with the instructors through an online forum. The contents of these interviews and discussions were analyzed to observe any emerging themes. The themes were used to condense the discussions into meaningful summaries to be used to help describe the learning environment of the course.

The Courses

The Virtual Assistive Technology University (VATU) offers a coordinated program of study in assistive technology, Web access, specialized software, and universally designed curriculum consisting of six 3-credit courses, leading to a certificate. A capstone seventh course will be offered for teacher educators on strategies for preparing personnel utilizing electronic environments to implement assistive technology, specialized software, Web accessibility, and universally designed curriculum. The courses, offered for either graduate credit or CEU's, are administered by the University of Southern Maine's Professional development Center (PDC).

The courses are described as follows:

EPA 504 - Introduction to Learning Technologies for Students with Disabilities
Prereq: None
This course provides an overview of topics related to assistive technology, specialized software, Web accessibility, and universal design in curriculum. The course will examine assistive technology definitions and legislation, the computer as a piece of AT, input AT and software, output AT and software, processing and organizational AT, physical education AT, assistive technology assessment and evaluation, and Web accessibility.

EPA 500 - Web Accessibility and Interactivity
Prereq: None
Participants will examine, evaluate, and implement strategies and techniques for accessible Web design and use. In this context, accessibility means that the menus are readily navigable and that the content itself is in a format that users with disabilities can "read" independently. Besides teaching universal Web design, the course is intended to model how to use multimedia on the Web in ways that enhance access for all users. Participants will examine and implement strategies for promoting active Web-based learning using interactive instruction approaches.

EPA 501 - Universal Design in Education: Access to the General Education Curriculum
Prereq: None
This course will demonstrate how the learning, social, and physical aspects of PreK-12 general educational environments can be enriched by applying the concepts and principles of Universal

Design in Education (UDE). UDE means that learning, social, and physical environments are designed so that individuals with a wide range of abilities can have meaningful access and participation in general education. Content knowledge and skills will be mastered through observations, reflections, online lectures, simulations, case studies, and online group discussion. Topics include the origins of the concept of universal design, current principles and application of universal design as it relates to education, technologies that support UDE, curriculum and instruction that align with UDE, and the creation of physical and social learning environments that meet the needs of the widest possible number of students.

EPA 502 - Using Assistive Technology for Educating Students with Low Incidence Disabilities
Prereq: None

This course provides participants with an overview of low incidence disabilities and assistive technologies that can be used to support children and youth who have these disabilities. Topics include working with children and youth who have challenging motor control, positioning for stability, writing effective equipment justifications, and understanding roles of team members. The use of switches to support students with low incidence disabilities will be examined. Course participants will fabricate simple switches and low-tech positioning devices. Class discussions and readings will enhance participants' understanding of the possibilities of simple switch technology.

EPA 503 - Augmentative and Alternative Communication
Prereq: EPA 504, Introduction Course

The purpose of this course is to familiarize participants with augmentative communication devices and the strategies for using these devices. Topics include low-tech communication devices and strategies, types of communication devices, static and dynamic display systems, augmentative communication software, and access methods and strategies. Participants will learn how to modify environments to support the augmentative communicator and how to perform a characterization match for selecting tools that meet communication, environmental, instructional, and vocational needs.

EPA 505 - Determining Assistive Technology Needs
Prereq: EPA 504, Introduction Course; EPA 502, Low Incidence; EPA 503, Augmentative Communication

This course is designed for educators and other professionals who work on teams to assist students with disabilities in selecting, acquiring, and using assistive technology (AT) devices. Topics include developing an understanding of a theoretical framework for gathering information about the individual's strengths, expectations, and tasks to accomplish; collaborating with team members from other disciplines; working with individuals and their families; writing AT into the IEP; and preparing documentation. Participants will learn how to work with the student to uncover AT needs and preferences, learn approaches to gathering information, understand the

decision-making process, evaluate effectiveness of devices, formulate recommendations, and prepare an AT report.

EPA 506 - Seminar on Integrating Technology Into Educational Programs
Prereq: All six previous courses

Activities include electronic discussions with colleagues and the instructors, online readings and reactions, interactive projects with a selected student or group of students, and application of assistive technology tools and strategies to your local school or district.

Findings and Analysis

The introductory courses are seven weeks long with two sessions each week. Each session has a presentation that conveys the content of the course. The Web-based nature of this presentation has the advantage of referring the learners (through hot links) to other resources on the Web as they proceed through the presentation. This feature allows the learner to use additional resources to fill in any gaps that there might be in their knowledge of the subject being discussed. The necessity of having to search out other resources to supplement their continued understanding, encourages the participants to engage in an activity that promotes deep and durable learning. The learning principle strongly supported by empirical evidence is that students must be required to become active participants in their own learning (Hacker and Niederhauser, 2000). Before each presentation, the participants are asked questions that assess their prior knowledge of the presentation topic. For example, "Week 3A's presentation will focus on the built-in accessibility of Windows and Macintosh operating systems. Are you familiar with these features? Please share what you know in this forum." This questioning prepares the students to seek the appropriate resource links available to them as part of the presentation to help them construct a thorough understanding of the concepts involved. In this way the questioning encourages the students to become active participants in their learning. After the presentation, follow up questions, posted on the discussion board, seek to assess how the learners knowledge has changed after participating in the presentation. The participants are asked to reflect on their understanding of the topic that was presented. The reflections on their change of understanding about the presentation topic are posted on the discussion board so that they can go through peer review. Reflection on their understandings and how these understandings have changed causes the participants to engage in a process that has been called "reflective abstraction". Reflective abstraction is a process of knowledge construction described by Piaget as a means of developing deeper and more abstract levels of knowledge. Other researchers have asserted that reflective abstraction "refers to a process in which the student tries to construct abstract structures and operations by reflecting on his or her own activities" (Lehtinen and Repo, 1996. p. 108). The participants in the VATU courses are required to critically reflect on their previous conceptions related to assistive technologies and how these technologies can be applied to their own classrooms. The participants must further reflect on how these conceptions have changed due to participation in the bi-weekly presentations. The cognitive process of critical reflection on individual understanding of concepts has been described as an

activity that may promote improved retention and deeper understanding of concepts (Kuech, 1999, Mackin, 1998).

The importance of peer discussion in the development of learning for understanding is a major influencing factor in the structural organization of the VATU courses. A key premise used by the developer in the structural organization of the introductory courses is that learning is a social endeavor and that it is through the social construction of knowledge that one learns for conceptual understanding. By requiring the participants to post their reflections related to their conceptual change as influenced by participating in the presentations, the developer promoted a "community of practice" among the course participants. It has been previously asserted that if the course can establish a "community of practice" among the participants, it could provide the ideal environment for learning (Hung, 2001). Hung (2001) also stated that learning through a "community of practice" is tightly tied to assertions about situated cognition in which context is closely associated with learning and understanding. Learning according to this paradigm, occurs through the social act of participating in a community of practice and the development of increased understanding of one's own beliefs. From a Vygotskian perspective, the participants are scaffolded across their "Zone of Proximal Development" by using the additional Web resources provided in the presentation. Further scaffolding occurs through suggestions made by the instructor and also by the peer participants. Questions that go unanswered after the presentation and additional Web-based resources are used, can be submitted to the discussion board for further help from peers and instructors. The learners' participation on the discussion board placed them in a "rich situational context allowing for interactional struggles in cognition" (Hung, 2001, p. 284) as they submitted their inner thoughts for peer review. Through the peer review interactions, the participants must make their inner thoughts visible for themselves and others to see and evaluate. It is through these types of cognitive processes that Torney-Purta (1996) reported "the participants make public and examine their own assumptions . . . they co-construct and challenge each other's opinions and strategies" (p. 209). This "baring of thoughts" causes learners to reflect on their understanding and often requires restatement and elaboration of the assertions that they have posted to the discussion board. The processes of reflection, restatement and elaboration have been demonstrated to promote deeper understanding of the concepts being discussed (Kuech, 1999).

Implications

The intersection of the research on effective teaching and learning and electronic learning is important because technology is an integral aspect of our lives both in and beyond school. The question is no longer whether or not to use technology, rather, how it can be used most productively. The online discussion and group project model used in the design and delivery of the VATU introductory courses promote many of the interactions that have been described in the literature as methods of promoting learning for understanding. The critical reflection on their understanding of assistive technology concepts linked with peer feedback on these understandings, are processes reported in the research literature that may promote conceptual discussions leading to deeper understanding (Kuech, 1999).

For people with disabilities, the permeation of technology into our lives and our education has created both new possibilities and new barriers to learning and communication. The social learning of knowledge, skills, and ideas emphasized in this paper brings together effective technology use and principles of effective learning which are important for all students of multiple abilities and talents. Strategies for effective instruction for people with disabilities are well-documented and invariably are helpful for all learners. Important elements include clearly organized content, models and exemplars, systematic instruction that teaches necessary basic knowledge and strategies; and guided practice and feedback. (Swanson, 2001). Embedding social learning into the VATU certificate is an important first step in the creation of a pedagogical framework which also addresses the importance of understanding the content and how assessment and reflection support Web-based learning and improve Web-based teaching.

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