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ABSTRACT

The VETO project is part of the Ministry of Education national strategy to develop an Information Society Program in Finnish schools. The focus of the VETO project is to develop and identify relevant guidelines for the implementation and integration of network based education solutions in vocational schools. The purpose of this study was to evaluate how and what kinds of learning contexts and processes network based education support in vocational schools and the workplace. Several questions guided the study: What teaching practices (pedagogy) did network based learning environments support in vocational schools? What delivery and productivity tools were used to create and design network based learning environments? What usability issues were associated with network-based learning environments in vocational courses? What implementation strategies did vocational teachers use? Three major indicators of technology integration were identified: netpedagogy, technology, and usability. These indicators were studied within the context of vocational teachers' planning, implementation, and evaluation. (Contains 21 references.) (AEF)

Guidelines for Developing Network Based Education in Vocational Schools

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Abstract: The VETO project is part of the Ministry of Education national strategy to develop an Information Society Program in Finnish schools. The focus of the VETO project is to develop and identify relevant guidelines for the implementation and integration of network based education solutions in vocational schools. In this paper, we identified three major indicators of technology integration. These indicators were netpedagogy, technology, and usability and were studied within the context of vocational teachers' planning, implementation, and evaluation.

The purpose of this study was to evaluate how and what kinds of learning contexts and processes network based education support in vocational schools and workplace. Several questions guided the study: What teaching practices (pedagogy) did network based learning environments support in vocational schools? What delivery and productivity tools were used to create and design NBL environments? What usability issues were associated with network based learning environments in vocational courses? What implementation strategies did vocational teachers use? Three underlying theoretical frameworks guided our inquiries: teachers' pedagogical knowledge (Grossman, 1990, Shulman, 1986), constructivist and socio-cultural learning theories (Collins, Brown, & Holum, 1991; Jonassen, Davidson, Collins, Campbell, & Haag, 1995), and instructional design models (De Corte, 1995; Lehman, Newby, & Ahn, 1998).

Literature Review

The scope of the literature review is to describe the conceptual framework by which we evaluated network based learning environments in vocational education. The conceptual framework is grounded in the following principle: "Powerful learning is characterized by a good balance between discovery learning and personal exploration on the one hand, and systemic instruction and guidance on the other" (De Corte, 1995, p. 41). For this reason, we guided our research based on three technology integration indicators. These were netpedagogy, technology, and usability. We framed these indicators within the context of technology integration: Plan, Implement, and Evaluate (Newby et al., 1996).

Before the selection of delivery tools and any other technological devices, teachers must determine what exactly they want to accomplish. This begins by selecting a pedagogical strategy that drives the selection of the technological tool, which in turn must work well over the World Wide Web. The idea is not to use technology for its own sake but to be driven by pedagogical considerations (Chizmar & Walbert, 1999). A brief look at the research reports on online education shows that most of the issues pertaining to it are clearly pedagogical, not technological (Lee, 1997). Laurillard (1996) said this best:

> So we must not begin with what the new technology offers. Examining instead what students need, we are led to a quite different analysis of how new technology can help. Most importantly, it should (a) give students more opportunities to engage with the practice of their subject; and (b) give them more opportunities to discuss and articulate their ideas.

Netpedagogy

We believe that good teaching practices should support deep approaches to learning by encouraging learners to participate in activities that promote "deep understanding of subject content, the ability to analyze and synthesize data and information, and the development of creative thinking and good communication skills" (Alexander, 1995, p. 6). Behaviorist learning theories are best known for supporting learning that its main goal is to impart facts, procedures and rules. Instructional goals based on behaviorist theories are frequently used in vocational education for facilitating initial factual knowledge acquisition in a field (Doolittle & Camp, 1999). Cognitive learning theories view learning as an active mental process of acquiring, remembering, and using knowledge. Learning is evidenced by a change in knowledge that makes a change in behavior possible.

When the instructional goals require that learners engage in the active production of knowledge, constructivist and social cultural theories of learning become the instructors' choice. Adherents of *constructivism* suggest that through the use of higher order thinking activities and the encouragement of ownership of learning deep understanding can occur. Some of the approaches used to facilitate higher order thinking are those that encourage analysis, synthesis, problem solving, reflective thinking, and metacognition (De Corte, 1995). By giving learners control over how to plan, design, and work, and encouraging them to generate hypothesis and to pursue the end result are some of the ways in which learners' ownership of learning can be supported. *Social cultural learning theories*, in addition to supporting these types of deep approaches to learning also advocates the use of authentic activities that simulate the level of complexity expected in the terminal performance (Lave & Wenger, 1991; Pantel, 1997). Another activity promoted by social cultural learning theories is the use of legitimate peripheral participation. That is, novices in the field observe experts and other learners from the side (Lave & Wenger, 1991).

On the whole, learning theories guide the development of instructional materials. They identify for the instructor the types of activities that must be available for the goals of the instruction to be achieved. Before evaluating learning materials, we must look at the pedagogical approaches chosen for the development of the materials. This means that the instructional goals and perhaps overall curriculum must be clear to the teachers, since these goals will drive the focus, evaluation, and ultimately the production and selection of network based learning materials and environments and other related network based pedagogical decisions.

Technology

Technology is a key issue in online learning. It deals with issues on how to choose tools that can best help prepare the individual components of the learning program, which tools can help bring together the individual components into a single course, and which tools are most effective in managing online learning (Carliner, 1998). Technology tools help to develop course materials and deliver these.

> Developing [course materials] consists of the software used to prepare the learning materials for presentation online, such as the elements of a database used to manage knowledge, a module in an online tutorial, a lesson in a course that's broadcast on the Internet, or a tool to monitor a worker's performance and provide relevant coaching. Delivering [course materials] consists of the hardware and software needed to store learning materials and transmit them to learners when and where the learners need them (Carliner, 1998).

Usability

The issues that relate to usability in network based learning environments are enormous and range from design issues to technical issues. After determining the instructional goals and selecting the technology tools and pedagogical practices that can help us attain these goals, teachers are ready to develop network based learning materials. The teacher must decide on the most appropriate learning environment based on his or her pedagogical orientation, instructional goals, students' abilities, and resources available (Moreno, 1999). If the decision is for using computer mediated instruction, such as network-based education, then the teacher must be aware of some basic usability design issues that deal with content, navigation, layout, and interactivity.

Methodology

The underlying methodology of this study is phenomenology. Phenomenology is "the study of how people describe things and experience them through their senses" (Patton, 1990, p. 69). The basic assumption underlying this inquiry paradigm is that individuals can only know what they experience "by attending to perceptions and meanings that

awaken [their] conscious awareness" (Patton, 1990, p. 69). Hence, we can only get to people's perceptions and meaning through interpretation. Interpretive research "is interested in including the meanings of actions from the actors' point of view" (Erickson, 1986, p. 120). The interpretivists "focus on the process by which these meanings are created, negotiated, sustained, and modified within a specific context of human action. The means or process by which the inquirer arrives at this kind of interpretation of human action is called Verstehen (understanding)" (Schwandt, 1994, p. 120). Verstehen refers to "the process by which we make sense of or interpret everyday world" (Schwandt, 1994, p. 120). It is the "process of comprehending and grasping what has been interpreted in a situation or text" (Denzin, 1989, p. 32).

Site and Participants

The vocational schools were selected from a group of projects funded by the National Board of Education (Opetushallitus). The National Board of Education selected these projects because of their initiatives in using network based learning environments in vocational education. For this study, we chose three teachers. All participating teachers came from different vocational areas.

Teemu taught at a Vocational Institute. The teacher was in the process of planning and developing a course on the Basics of Multimedia. He expected to potentially teach hundreds of students at a distance. He used computers with his students because of the nature of the course. Even though WebCT was available to use, the teacher chose not to use it. He found that WebCT was good as a management system, but found it quite inflexible for producing content. He instead used other software for producing content. He found getting students to use collaboration and communications tools was "almost impossible". He also chose not to use WebCT with his students because he had heard that students had difficulties learning how to use it.

Sanna taught at a Commercial institute. She supervised 37 students during their work place training. This was the first time she guided students training using the Internet. She participated in a training session on how to use WebCT, but felt that "it wasn't enough" to feel comfortable with it. She and her students used the Internet for searching Web pages, sending and receiving e-mail, exchanging information and tasks. While using the Internet during one of her face-to-face sessions with her students, the server went down and students could not access any web sites. This experience taught her no to trust the technology and to have other options ready. Overall, this teacher kept a critical attitude toward the use of the Internet.

Marjut and Anni taught a course in Basics of Hygiene at a Health Care Institute. This was their fourth time teaching the course. They taught 20 students (5 groups during the school year) ages 15 to 16 years old. The teachers used the Internet to teach this course, because they believed that it helped increase student motivation for the course. Another reason for using the Internet (or network) for learning was the great possibilities to visualize concepts, besides the opportunity to learn the material out of class.

Data Collection

Interviews focused on how vocational teachers plan, implement and evaluate the learning processes (pedagogical practices, learning materials, and technology). The researchers contacted the teachers over the phone and arranged a face-to-face interview. In the future, we plan to observe the actual lessons as well as to go through their teaching and learning materials to make a thorough evaluation of the usability issues.

Data Analysis

The data analysis from the interviews was arranged in terms of teachers' netpedagogy (i.e., practices for fostering learning, knowledge building, and stimulating environment) and technology uses for production of NBL environments and delivering of teaching and learning materials. There is a brief analysis on teachers' navigation structure of their Web sites. A more formal evaluation on teachers' usability issues will be performed later.

Practices for Fostering Learning and Knowledge-Building

The literature suggests three practices for fostering learning with network based learning environments (Pantel, 1997; Wilson, Jonassen, & Cole, 1993). These are scaffolding and fading, cognitive apprenticeship, and collaborative learning. All these practices originate from constructivist and social theories of learning. Besides fostering knowledge, we want students to use their knowledge in new situations. Some of the practices used to

bridge the gap between schools and job settings are case-based approaches, simulations, and microworlds (Wilson, Jonassen, & Cole, 1993).

Scaffolding and Fading

None of the teachers used sophisticated programs to allow for automatic tracking of students' performance and adjust the level/feedback of the instruction. The materials placed on the network (Internet) provided links to relevant information or self-contained instruction. For instance, in Teemu's course, Basics of Multimedia, students followed a module-based instruction that contained exercises and information. If students encountered any problems they could ask him or he would have them looked on the help manuals. Sanna, the supervisor of the Work-place training course, used the e-mail to help students with any questions. The nature of the course, work place training, may have allowed for scaffolding and fading, although no conscious planning for this was described. Sanna kept relevant links on the course web site to help students during the work place training. She also helped students through their face-to-face contact and e-mail. Marjut and Anni, the Health Care teachers, had instructional materials on the web to help students understand the basics of aseptic (e.g. hygiene) in health care. The course included a practical training session. To prepare students for the practical training we could assume that teachers might have used some sort of scaffolding and fading for fostering learning and knowledge-building.

Collaborative Learning

Only the Health Care teachers, Marjut and Anni, incorporated collaborative learning in their course, although individual work was also expected. The teachers arranged students into five groups. Within each group, students discussed the materials introduced in the classroom and/or WebCT. The teachers required students to bring their thoughts and answers to the specific tasks to the discussion forum and expected students to also comment on what other students had to say. To encourage the use of the discussion forum, the teachers evaluated the discussions that took place at the forum. Besides using Web-CT's discussion forum, students also used chat, e-mail, and electronic calendar. Teemu did not think of using collaborative and communication tools with his students. "I was thinking not to use any collaborative and communication tools in my own course, although many researchers emphasize the activeness of changing opinions and so on. I feel that it is almost impossible to get students involved in network conversations, especially in vocational education (intermediate level)." Having said this, at the end of the interview he felt that perhaps he should reconsider his view on collaborative learning and try to understand the gist of it. He felt that many times the "group work does not necessarily progress they way that is wanted." Moreover, he feels that the Internet feels more like a tool for behavioristic learning. In Sanna's course, students worked individually. She planned to incorporate this type of learning in the future. During the interview, she suggested that she could have a student who works on a travel agency share his/her experiences with another students in a hotel, and together they could compare their experiences by chatting.

Cognitive apprenticeship

Teemu considered himself the students' coach and expert. He would model for his students the different multimedia software. In terms of creating a real work experience, he had not thought about that.
Sanna's practical training course allowed for cognitive apprenticeship to occur. At the workplace, students were placed with a tutor, who guided them and showed the basic details of their job. Marjut and Anni have incorporated into the course several hours of practical training that gave students the opportunity to learn while doing. From the feedback received from students, they planned to add to the instructional materials on the web some "unexpected things" to happen. These changes, however, would take place on their advanced course on Hygiene. One of the most significant changes was the inclusion of a patient that students could follow up on what happens to him/her when specific treatments are chosen or ignored. This would allow students to think critically about the information presented.

Practices for a Stimulating Environment

Any instruction must consider strategies in order to provide a stimulating environment where learners feel safe and motivated to learn. Network based learning environments must support ways in which learners perceived ownership of learning, become challenged with higher order thinking activities, and participate in authentic activities.

Authentic Activities

All three courses provided a level of authenticity to the tasks that students had to perform. Sanna's course by its very nature gave students the opportunity to work on an actual setting (i.e., hotel or travel agency). Marjut and Anni had the practical training component in the course that gave students a sense of authenticity. Also, in the advance hygiene course by adding a "patient" to the instructional material on the Web, students could see the consequences of their actions. In Teemu's course students learned the software program's features that they most likely would use in a work setting. He does not try to teach as if all students would like to become multimedia designers. Instead, he provided students with specific information that was pertinent to the specific software program.

Technology

Productivity and Delivery tools

For creating the instructional materials, Teemu used PhotoShop, Dreamweaver, Gleener5 and Sampletude programs. Sometimes, he just used the browser's editor for coding html. Overall, he felt that the Macromedia tools were the most practical and popular. As a delivery tool, he used one of the Internet browsers available on the market, although he was aware that WebCT was a good tool for managing the content. However, he felt that for developing "flashy" or stylish material it was better to use one of the other productivity programs and then use WebCT as a management tool. Sanna used Word as a productivity tool. She gave a technical person a manuscript with information on the tasks and contents and other information on how she wanted it to appear on the Web. At this point, she was still not using WebCT, although she was positive about its benefits in the course.
Marjut and Anni used PhotoShop, Pagemill, and Netscape's editor. They used it because they were available when they started working on this project. They got professional help for learning how to use these tools. As a delivery tool, they used WebCT because the city where their Institute is located purchased a license for it. They had looked over Lotus Learning Space and thought that WebCT was a more simple and easy to use learning platform.

Usability

Teemu used a linear structure and organized the information in modules. The Web site in Sanna's course was primarily used as a resource of Web site links. Marjut and Anni used the WebCT to manage the instructional Web sites. The navigational structure of their Web sites was referential.

Discussion

Network based learning environments provides unique instructional capabilities that never before could have been attained. Learners can link to a great array of information sources. They provide support for new instructional approaches, such as cooperative learning with other learners at a distance, demonstrations, online references, powerful simulations, tips, tutorials, and wizards (Carliner, 2000). Network based learning increases teacher productivity by providing accurate information about students' progress more quickly, allowing teachers to help more learners at one time. They offer new ways to think about the design and learning processes. Network based learning can be tailored to individual learning and working styles, provides learners with different ways to experience the content (e.g., text, video, animation, graphics), allows learners to actively participate in the learning process by sometimes exchanging ideas, questions, and concerns with experts and other students. Ultimately, through effective design, the network based learning environment can track learners progress and provide alternative explanations and/or exercises until they understand it (Carliner, 2000).

In addition, for the power of network based learning to be realized, administrator and teachers must have a plan for the technology integration and management (Carliner, 2000; Newby et al., 1996). The first step is to form a technology committee. This committee should represent all the stakeholders including parents, community, and students. The second step is the development of a vision. The vision should meet students, teachers, curricular, and societal needs (Newby et al., 1996). The next step is the evaluation of the status of technology implementation. This step must be completed prior to the technology committee becoming too specific about its technology implementation plan. Some of the information that should be gathered during this step is to catalog hardware and software resources, identify current uses of technology, assess faculty and staff proficiency, and evaluate students' use of technology. The final task of the technology committee is to develop a framework for integrating technology that takes into consideration the availability of hardware and software, curriculum, and individual's teaching styles.

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