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Abstract

This paper describes the screen capture videos as a complementary addition to conventional lectures in the learning of the basic concepts of information management and information systems development. Our basis is problem-based learning with the problems defined by students. The idea is that students are expected to find concepts or issues from our lecture material which are not well-defined or clarified for them. We utilize conventional lecture material, search engines on the web, and Optima e-learning environment. The solution enables a web-based seminar supporting learning in various ways. First, in our approach the students compose a Windows Media Player video focusing on the self-defined problems of the subject area. The source material for this video is collected by using search engines on the web. Second, in the web-based seminar students can familiarize themselves with the videos of other students. We claim that in this way learning can be promoted in the spirit of both cognitive and social constructivism as well as the philosophy of YouTube video service.

We ran our problem-based seminar in the fall of 2006. The students worked in small groups of two or three students or they completed the coursework individually. In this seminar on the web the students had a workspace in the Optima environment for publishing their coursework videos. At the final phase of the course the students were expected to familiarize themselves with the presentations of other groups. In this paper we analyze the benefit of our problem-based seminar based on the goals of the course. At the beginning and end of the course the students were expected to analyze their own knowledge of the themes of our course. These themes were: (1) administrative view to information resources management, (2) technological view to information resources management, (3) building information systems, and (4) organizational applications. In addition, the students were expected to analyze how they experienced the coursework.

Keywords

Learning of information systems, screen capture videos, web-based learning environment, constructivist learning, problem-based learning.

Introduction

In a traditional classroom, learning occurs in the behaviorist manner (behaviorism). The traditional classroom puts a learner in the position of an object of assessment: an instructor initiates, a learner responds, and the instructor then closes the sequence by either accepting or rejecting the learners' turn (Sinclair & Coulthard 1975). The constructivist learning approach (constructivism) contrasts to the behaviorist approach. From the perspective of these learning approaches, the last decade has been the time of constructivism even at the university level.

Traditional lecture-based teaching is problematic in many ways (Isaacs 1994 & Rosenthal 1995). Problems associated with this type of teaching include ineffectiveness, passiveness, and alienation of students. In the context of technology and related sciences, some revisions have been suggested to improve lecturing as a teaching method by activating students using, for example, co-operative learning in small groups and essay-writing assignments about technical topics (Isaacs 1994). From this perspective lecturing is not without potential if the previously mentioned problems can be corrected, but other learning methods must also be considered.

In the constructivist approach learning is comprehended as the development of mental models. Brandt (1997) emphasizes that constructivism is an essential basis when applying the web for teaching and learning. It provides the teacher with a structure for teaching. By focusing on concepts and connecting them to mental models, teachers can gain both confidence and control over the amount of material they cover in the small blocks of time usually allotted to teaching and training. Integrated with experiences that learners use to alter and strengthen mental models, the constructivist approach to teaching information retrieval also gives users the structure needed to get the most out of the Internet.

The era of the web 2.0 has brought new ways to publish works on the web (Wikipedia 2007). The web can be seen an active tool supporting collaboration. One of these new ways for publishing is videos. YouTube video service has promoted this significantly. In the spirit of the YouTube student can compose videos by themselves and publish them on the web. In this way they can use video making tools in the spirit of constructivism allowing active learning experiences. One tool for video-making is Windows Media Encoder (WME) which enables capturing screen and voice narration at the same time. These videos are playable in most media players including, for example, Windows Media Player.

Based on the aforementioned we use a problem-based coursework focusing on the problematic concepts of the learning area. First in this coursework, students need to report what these difficult concepts are by familiarizing themselves with a lecture handout. Second, the students need to search area-related information on the web and give some examples of learning. In this way the students can focus on the main concepts and enrich their learning in a constructivist way and the web can help them learn difficult concepts in particular. Based on this acquisition of information students can compose WME videos in which they teach other students to understand these problematic concepts better. The students can utilize this video material at any time and any place and in this way WME videos are more useful in education compared to traditional live presentations.

The social constructivist learning theory emphasizes the meaning of interaction in successful learning. For realizing these benefits in our web-supported coursework we suggest the use of a virtual learning environment (Optima) and its shared workspace feature. This occurs by publishing videos; by commenting on seminar works created by other students (or groups) and by reading comments expressed by other students. By using a virtual learning environment the students can use their own language to teach each other to understand problematic concepts.

This paper introduces our approach to carry out a web-supported coursework and seminar. Additionally, it provides the analysis of the approach by focusing on the success of our coursework and seminar from the perspective of the goals of the course. To achieve this, we compared the ratings of the students who completed the web-supported coursework to the ratings of the students who did not participate in this coursework.

Our analysis has many goals. We want to know

- how the students' knowledge of different themes was improved,
- how the students experienced the coursework methods, and
- whether age and group size affected the effectiveness of the learning of different themes.

Because of active constructivist learning, we claim that our approach may produce better results in learning compared to traditional teaching and learning. Before discussing the study itself, we first provide an overview of constructivism and the WWW in learning from the perspective of our study.

Constructivism

Widely known and discussed views associated with (computer-supported) learning include behaviorism and its opposite, constructivism. Behaviorism is interested in a student's behavior (reactions) in relation to teaching (stimulus) while constructivism is interested in the mental processes which affect the behavior of a student (Risku 1996). A traditional lecture is mainly based on the behaviorist approach while coursework and projects are typical constructivist learning. Most web-based instruction today is based on behaviorism (Morphew 2002).

Jonassen (1994) summarizes what he refers to as "the implications of constructivism for instructional design". The following principles illustrate how knowledge construction can be facilitated by:

- providing multiple representations of reality,
- representing the natural complexity of the real world,
- focusing on knowledge construction, not reproduction,
- presenting authentic tasks (contextualizing rather than abstracting instruction),
- providing real-world, case-based learning environments, rather than pre-determined instructional sequences,
- fostering reflective practice,
- enabling context-and content dependent knowledge construction, and
- supporting collaborative construction of knowledge through social negotiation.

According to Brandt (1997), constructivism asserts that learners construct knowledge by making sense of experiences in terms of what is already known. In constructivist learning the concept of a mental model is essential. Learning is comprehended as the development of a learner's mental models (or a student's knowledge structures). Brandt (1997) emphasizes that constructivism is an essential basis when applying the WWW for teaching and learning. While the goal of constructivism is to recognize and help to facilitate a learner's ability to construct knowledge when applied to teaching information retrieval on the Internet, it also provides the teacher with a structure for teaching. By focusing on concepts and connecting them to mental models, instructors and teachers can gain both confidence and control over the amount of material they cover in the small blocks of time usually allotted to teaching and training. Integrated with experiences that learners use to alter and strengthen mental models, the constructivist approach to teaching information retrieval also gives users the structure needed to get the most out of the Internet.

The WWW and its hypermedia nature enable learning by constructing knowledge in the sprit of the cognitive school of constructivism. Cognitive constructivism emphasizes that learning occurs through many channels: reading, listening, exploring and experiencing his or her environment (Piaget 1977). Furthermore, the WWW and web-based learning environments support learning based on social constructivism by providing different ways of communication. The social constructivist theory emphasizes the influences of cultural and social contexts and interaction in learning (Vygotsky 1978).

Problem-based learning is one implementation of the constructivist model of learning and the practical implementations of it can vary (Nuldén 1999). By applying problem-based learning to constructivist learning students can concentrate on what is really difficult. According to Ellis et al. (1998), in a problem-based learning environment, students work in groups on real-life problems and have the opportunity to determine for themselves what they need to learn in the relevant subject area(s). Based on the aforementioned one approach to problem-based learning can be familiarizing with an area to learn first. This phase can be followed by determining difficult concepts to learn and this could be the basis for an assignment. The assignment can occur on the web using different resources, such as search engines and directories. In this way students can bring fresh and clarifying views for themselves and fellow students in their own language.

Despite the promise of constructivism several researchers emphasize the importance of guidance. For example, Silverman (1995) points out that by providing the right amount of traditional instruction, students seem to favor constructivist environments. Additionally, he suggests different tools (e.g. a multimedia authoring environment, better communication media, and easily integrated microworld simulators) to support lessons based on the constructivist approach.

The WWW in learning in our context

Vast information resources are available to teachers and students via the WWW. However, the problems inherent in any information system such as disorientation, navigation inefficiency and cognitive overload are multiplied on the Internet (Brandt 1997). On the other hand, these problems can be overcome using a suitable pedagogical approach and/or appropriate tools.

In the case of coursework one approach may be by seeing Internet tools as cognitive tools, in other words, tools for knowledge construction. A cognitive tool is a term introduced by Jonassen in his discussion of hypermedia tools (Jonassen 1992). He claims that cognitive tools actively engage learners in the creation of knowledge that reflects their comprehension and conception of the information rather than focusing on the presentation of objective knowledge. These tools are learner controlled, not teacher or technology driven. The use of a cognitive tool changes the role of the student into that of an active learner. Figure 1 (see next page) shows cognitive tools in the general three-dimensional framework for computer-based learning. (Jonassen 1992). These dimensions are generativity, control, and engagement.

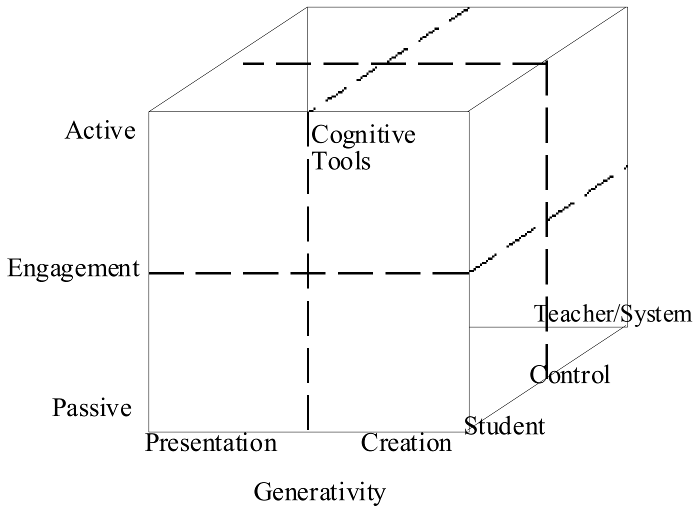

Figure 1. Cognitive tools in the general framework of computer-based learning.

In the same way, web-based tools, like Optima, can be seen in an active context. The students can use Optima and its presentation feature for introducing their ideas, receiving feedback, and managing coursework. This leads to learning by constructing knowledge based on both a student's own ideas and other students' ideas.

In the case of a web-based seminar it is useful to discuss the use of the WWW from the perspective of media research. Haythornthwaite (2001) stresses the interpersonal ties that affect the character of web-based communication. According to her, strong ties between students improve web-based communication: based on this we claim that traditional teaching and learning are needed as a part of a course. The traditional parts of a course develop these ties in the way that is not possible in a totally virtual training setting. In this way we can create contexts in which effective WWW-based learning is possible.

Based on the above, it is important to appreciate these views of learning while outlining courses and to understand the use of the WWW in learning. We stress the following three issues. First, we must discuss what the right amount of traditional (behaviorist) teaching should be. Second, we must analyze what is the right way to use the WWW. Active learning must be promoted and situations conducive for successful web-based learning must be created. Third, scaffolding support is needed to support constructivist learning based on the WWW. We claim that after the introductory course level many courses of information systems science can be built on the constructivist approach of learning. Practically, this occurs by organizing a comprehensive coursework that works as the core of a course. This coursework should cover as many course topics as possible.

Methods

We pursued the study, including a problem-based coursework, and using Windows Media Encoder as well as the Optima environment. In this section we describe our experiment, sample, and results.

Experiment

At the University of Jyväskylä in Finland, the themes of the course Information management and information systems development are (1) administrative view to information resources management, (2) technological view to information resources management, (3) building information systems, and (4) organizational applications. The course was inspired by a textbook, Information Technology for Management: Transforming Business in the Digital Economy (Turban et al. 2002). The course usually lasts for seven weeks including lectures (36 hours), coursework (feasibility study) as well as the final exam. The course given in fall 2006 also lasted for this length of time and included the above-mentioned activities and in addition material and activities on the WWW to support the lectures in the constructivist fashion combining both cognitive and social constructivism as well as problem-based learning.

To realize the benefit of problem-based learning and constructivism we organized a coursework in which students were expected to learn difficult course themes based on self-defined problems. The students were expected to familiarize themselves with the lecture handout of the course (128 pages) and try to find 5 difficult matters which should be better clarified. Based on these problems they searched for more information from the web to understand the possible difficult matters in our material. The students needed to report what useful links they found by using search engines and directories. They were expected make Powerpoint slides that included examples of what they have learned. The Powerpoint slides were the basis for videos. Videos were composed by using Windows Media Encoder and they contained Powerpoint slides and narration. The students were expected to clarify to other students what they can learn by seeing examples on the web. This part of the coursework was designed by combining problem-based learning and cognitive constructivist learning theory focusing on the concepts of the content area.

To promote the students' participation in the optional coursework, the students got credits for the final examination by completing the coursework. Although the coursework is a constructivist part of the course, the teacher's office hours were available as an additional resource to promote their work as well as scaffolding support. The students had six and a half weeks for the coursework before the final examination. The work was expected to be conducted as an individual task or in groups of two or three students.

The groups placed the videos on a web server. In the web-based workspace on Optima learning environment (see more details on the product at http://www.discendum.com/english/index.html) students created links to the videos on different servers and in this way the Optima enabled the single-point access to all the video material created by the students. Other groups were expected to familiarize themselves with these presentations. Additionally, it was possible to attach comments regarding any work of other groups on this workspace. For making the videos, the groups had six weeks. After these six weeks the groups were expected to comment on three other coursework presentations. These comments were placed in the Optima workspace. The students had one week for this. In the comments the students were expected to clarify what they learned by watching other students' videos. This part of the coursework was designed in the spirit of the social constructivist learning theory.

Figure 2 shows the first view of students' workspace on Optima. With the help of this outlook the students had a possibility to create links to videos on other servers and comment on the presentations created by other groups. By clicking a yellow button after the name of a presentation the students were able to comment on the videos of other groups. The commenting could occur either by typing plain text or using attachments such as HTML or Word documents.

Figure 2. Single-point access to videos of coursework.

Sample

Forty-three students, 12 females and 31 males, whose mean age was 23 years (range 18-39 years), participated in the experimental group including the problem-based seminar on the web. 7 students studied informatics as a minor and 36 students as a major. 10 of them completed the coursework individually, 21 in groups of two students, and 12 in groups of three students. We call this group the video group in this paper.

Thirty-five additional students, 13 females and 22 males, whose mean age was 25 years (range 19-52 years), were involved in the control group. 13 students studied informatics as a minor and 32 students as a major. We call this group the non-video group in this paper. The students in the control group completed the course without this assignment including video making.

All the students had been initiated into the use of a PC and a WWW browser, and all of them were familiar with university lecturing. Both the students of the video group and non-video group were expected to use the Optima learning environment for retrieving the course material. The pre-questionnaire conducted at the beginning of the course showed that the students both in the experimental group and the control group were at the same knowledge level concerning the main topics of the course: (1) administrative view to information resources management, (2) technological view to information resources management, (3) building information systems, and (4) organizational applications.

Collecting data

The data for this study was collected by administering a questionnaire both at the beginning and the end of the course. The respondents rated the personal knowledge level of four main topics with regard to how excellent they considered the knowledge of each topic based on a 5-point Likert (where 1=very poor and 5=very good). Additionally, the respondents rated how beneficial they considered the coursework of the course (where 1=very useless and 5=very useful).

Results

How students' knowledge was improved

Since the data based on the responses of the students concerning the goals of the course did not agree with the normal distribution, the Mann-Whitney test was appropriate for the analysis of the data. Additionally, because of our small sample size we selected this non-parametric test for analyzing the data. Concerning learning of different themes the study found that the problem-based coursework on the web was equally useful in the learning in all the cases. The statistical analysis did not show any significant differences between the groups. However, in all the cases the students of the video group learned the themes of the course lightly better compared to the non-video group. The details of the analysis concerning knowledge are shown in table 1.

Table 1. Analyzing the students' knowledge of different themes.

	Mean at the beginning of the course			Mean at the end of the course		
	Non-video group	video group	p	Non-video group	video group	p
Administrative view to information resources management	2,42	2,41	.923	3,20	3,32	.335
Technological view to information resources management	2,54	2,37	.402	3,23	3,33	.793
Building information systems	2,45	2,28	.380	3,43	3,58	.298
Organizational applications	2,40	2,11	.188	3,09	3,10	.943

If we compare knowledge at the video group at the beginning of the course to the end of the course, the statistical analysis shows that differences were highly significant ($p<.000$) in the learning of all the themes). However, in the non-video group these differences were varying from .001 to .008.

How students experienced coursework in general

Table 2 shows the students of the video group ratings on this coursework and seminar in general. The students were expected to rate how they experienced our coursework as a learning method. The result shows that their attitude is mainly positive concerning the coursework generally. The notable point is that no one agreed the meaning of the coursework very insignificant.

Table 2. Coursework generally.

n	43
Mean	3.88
Very insignificant	0
Insignificant	3
Moderately significant	7
Significant	25
Very significant	8

Evaluating the effect of age and group size

In order to clarify whether age affects the learning of different themes, the Pearson correlation coefficients were calculated. Based on the correlations age does not usually affect significantly the benefit of the web-supported coursework. The result indicates that our assignment suits for the all students regardless of age.

Table 3 shows the details of our analysis in the non-video group and table 4 in the video group.

Table 3. Analyzing ratings based on age in non-video group.

At the beginning of the course	Administrative view to information resources management	Technological view to information resources management	Building information systems	Organizational applications
Correlation Coefficient	.633	.360	.493	.463
p	<.001	.018	.001	.002
At the end of the course				
Correlation Coefficient	.290	.413	.178	.379
p	.059	.006	.258	.012

Table 4. Analyzing ratings based on age in video group.

At the beginning of the course	Administrative view to information resources management	Technological view to information resources management	Building information systems	Organizational applications
Correlation Coefficient	.158	.097	.174	.178
p	.365	.579	.317	.307
At the end of the course				
Correlation Coefficient	.243	-.048	.054	.270
p	.160	.784	.758	.117

By analyzing ratings based on group size we found that group size does not affect the learning of the themes. The Mann-Whitney test did not show significant differences in the ratings between the students who completed the coursework in the group of two students (n=21), the students who did the coursework in the group of three students (n= 12), and the students who completed the coursework individually (n=10) both at the beginning and end of the course (p varying from .014 to 1).

Discussion

In this paper we analyzed the effect of our problem-based coursework on the course topics to learn. The results show that a problem-based coursework including a seminar is a potential way to organize a web-based coursework if we have a crowded course. The results are promising because most teachers appreciate the cost-effectiveness of web-based education (Morphew 2002). Our comparisons show that the Optima-based coursework suits a little bit better for younger students and for students whose knowledge level of the information systems science is lower at the beginning.

Our results show that the students´ attitude concerning web-supported coursework was positive. This could be the basis for the next step of our research. As mentioned the constructivist approach of learning is divided into two schools. In our approach the first phase, creating a coursework video, represents the cognitive constructivist approach of learning. In this phase the main focus of learning is concepts. In contrast to this, the second phase, participating in a web-based seminar, represents the social constructivist approach of learning. The key point here is interaction and brainstorming through the web in this phase. Based on this it is fruitful to compare the attitudes of the students concerning the first and second phase of the web-supported coursework. The phases present different sides of constructivism.

The limitation of the study is that we did not compare traditional live presentations to these web videos. However, our approach can give many benefits compared to live presentations. The students can access videos as many as times they want. In traditional live presentations the students behave differently. According to Walter et al. (2004), they can turn visual attention elsewhere (i.e., to static slide or to their notepaper) while maintaining auditory attention on the speaker. Based on these facts we can claim that videos on the web may be the effective way of learning compared to traditional live presentations.

Nevertheless, this paper demonstrates that a successful seminar for a crowded course is possible using Windows Media Encoder and the Optima environment. Windows Media Encoder and related tools bring videos in the active way into the education. The Optima environment or other related tools enable web-based communities. In this way the WWW brings new possibilities for education and web-based communities are at least as effective as traditional learning settings.

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