Masters Thesis in Informatics

Net-based Learning in Higher Education

Christian Hardless

770613-5030

hardless@viktoria.informatik.gu.se

Supervisor: Urban Nuldén, Ph.D.

IA7400, Magisteruppsats, 20p, VT2000

Department of Informatics, Göteborg University, Sweden

Abstract

This thesis is an exploration of net-based learning in higher education, building on non-traditional pedagogical ideas such as constructivistic learning, collaborative learning, problem based learning and formative assessment. The objective of this research is to improve the design of net-based learning activities, and the overall research question asked in the thesis is:

How can the design of net-based learning activities in higher education be improved so that non-traditional approaches to learning can be successfully realized?

The research approach has been action research. A mainly net-based introductory course in informatics was given for second year undergraduate business administration students at a Swedish university. The findings of the thesis are based on the experiences from that course.

The thesis consists of five papers. There are three main results in this research. First, the Activity Visualization approach to improve social awareness in net-based learning environments. Second, Mandatory Participation as Examination, a model of examination for net-based learning. The third and overall result is the empirically based understanding of net-based learning, that offers a problematizing and critical analysis.

Preface

This thesis contains five individual papers and an introduction. The published papers are presented without any changes except for the required formatting to fit the format of this thesis. The introduction aims to provide a background for the individual papers, outline the research approach adopted and present the main results. The five individual papers are listed below.

- First Paper: Nuldén, U. and Hardless, C. (1999). Activity Visualization and Formative Assessment in Virtual Learning Environments. In Chambers, J. A. (Ed.) (1999). Selected Papers from the 10th International Conference on College Teaching and Learning, pp. 117-126. Jacksonville, FL: Florida Community College at Jacksonville.

- Second Paper: Hardless, C. and Nuldén, U. (1999) Visualizing Learning Activities to Support Tutors. In Extended Abstracts of the Conference on Human Factors in Computing Systems (CHI '99), pp. 312-313, Pittsburgh, ACM Press, 1999.

- Third Paper: Dippe, G. and Hardless, C. (1999). The new online teacher. In Nuldén, U. and Hardless, C. (Eds.) (1999). CSCL: A Nordic Perspective, pp. 29-35, Göteborg University.

- Fourth Paper: Hardless, C. and U. Nuldén. (1999). Mandatory Participation as Examination. In Proceedings of the World Conference on the WWW and Internet (WebNet '99), Honolulu, AACE, 1999.

- Fifth Paper: Nuldén, U. and Hardless, C. (2000). Mandatory Participation in Asynchronous Learning Networks. Submitted to 34th Hawaii International Conference on System Sciences.

The format of this thesis differs from the common format of masters theses, which is one single lengthy paper. Thus, this thesis is a contribution to finding new options for masters theses in the discipline of informatics.

Acknowledgements

I have been involved in research on IT-supported learning during three of my four years as an undergraduate student in informatics and this thesis is a result of that work. The participation in research has proved to be so stimulating that I am continuing my studies, now as a Ph.D. student in informatics.

There are many people to thank, not only for supporting me on this thesis but more importantly for making the years as an undergraduate student worthwhile. However, I will adhere to the none mentioned none forgotten principle. I will limit the acknowledgements to the two most important people when it comes to my studies and this thesis. They are foremost to blaim for me becoming a Ph.D. student, something that was not originally in my plans.

First, I wish to thank Urban Nuldén who has been a great mentor for me the last couple of years. He has generously allowed me to participate in his research projects and supported my development as an undergraduate student and junior researcher. Urban has the ability to make people rethink their conceptions about the world, and many of my previous assumptions have changed as a result of our cooperation.

Second, I wish to thank Per Dahlberg who has been a point of reference for me. Per has had a two year headstart on me, so I have been able to learn from his experiences and to a great extent walk in his footprints. This has been possible due to his open personality and ability to go out of his ways to be helpful.

Göteborg, May 2000

Christian Hardless

Table of Contents

INTRODUCTION: NET-BASED LEARNING IN HIGHER EDUCATION

1. INTRODUCTION 1

1.1 RESEARCH AIM 3

2. THEORETICAL BACKGROUND 3

2.1 CONSTRUCTIVISTIC LEARNING 4
2.2 COLLABORATIVE LEARNING 5
2.3 PROBLEM-BASED LEARNING 6
2.4 ASSESSMENT OF LEARNING AND EXAMINATION 7

3. TECHNOLOGICAL BACKGROUND 9

3.1 COMPUTER SUPPORTED COLLABORATIVE LEARNING 9
3.2 ASYNCHRONOUS LEARNING NETWORKS 10

4. RESEARCH APPROACH 11

4.1 METHOD 11
4.2 RESEARCH SITE 12

5. THE FIVE PAPERS 13

5.1 FIRST PAPER: ”ACTIVITY VISUALIZATION AND FORMATIVE ASSESSMENT IN VIRTUAL LEARNING ENVIRONMENTS” 13
5.2 SECOND PAPER: ”VISUALIZING LEARNING ACTIVITIES TO SUPPORT TUTORS” 13
5.3 THIRD PAPER: ”THE NEW ONLINE TEACHER” 14
5.4 FOURTH PAPER: ”MANDATORY PARTICIPATION AS EXAMINATION” 14
5.5 FIFTH PAPER: ”MANDATORY PARTICIPATION IN ASYNCHRONOUS LEARNING NETWORKS” 14

6. RESULTS 14

7. FURTHER RESEARCH 15

8. REFERENCES 16

FIRST PAPER: ACTIVITY VISUALIZATION AND FORMATIVE ASSESSMENT IN VIRTUAL LEARNING ENVIRONMENTS

1. INTRODUCTION 19

2. ASYNCHRONOUS LEARNING NETWORKS 19

3. THEMATIC MODULES **20**

4. FORMATIVE ASSESSMENT AND SCAFFOLDING **21**

5. EXPERIENCE AND TECHNICAL SOLUTIONS **22**

6. DISCUSSION AND FURTHER RESEARCH **23**

7. REFERENCES **24**

SECOND PAPER: VISUALIZING LEARNING ACTIVITIES TO SUPPORT TUTORS

1. INTRODUCTION **26**

2. TUTORING IN VIRTUAL LEARNING ENVIRONMENTS **27**

3. ACTIVITY VISUALIZATION **27**

3.1 ACTIVITYLINES 28

3.2 INDIVIDUAL HISTORY 28

3.3 EMAIL NOTIFICATION 28

4. EVALUATION **28**

4.1 EXPERIENCES OF TUTORING 29

4.2 COMMENTS AND IDEAS ON AV 29

5. DISCUSSION AND FUTURE WORK **30**

6. REFERENCES **30**

THIRD PAPER: THE NEW ONLINE TEACHER

1. INTRODUCTION **31**

2. THE TEACHER'S CHANGING ROLE **32**

3. THE LEARNING ENVIRONMENT **33**

3.1 ASYNCHRONOUS LEARNING NETWORK (ALN) 33

3.2 VISUALIZING LEARNING ACTIVITIES 35

3.3 SOCIAL INTERACTION 36

4. HOW CAN WE SUPPORT THE NEW TEACHER? **37**

4.1 METHODOLOGY FOR ONLINE TEACHERS 37

4.2 Educating new online teachers 38

5. INNOVATING EDUCATION 38

5.1. Problems with using IT in education 38

5.2 IT as a catalyst for improvement 39

6. CONCLUSION 40

7. REFERENCES 40

FOURTH PAPER: MANDATORY PARTICIPATION AS EXAMINATION

1. INTRODUCTION 42

2. ASYNCHRONOUS LEARNING NETWORKS 43

3. PARTICIPATION VERSUS PRESENCE 44

4. MANDATORY PARTICIPATION 45

5. EVALUATION 46

6. EXPERIENCES 48

6.1 New and different 48

6.2 Off-topic discussions 49

6.3 Mature and evolve 50

6.4 Teaching assistant frustration 50

7. CONCLUSION AND FUTURE WORK 51

8. REFERENCES 51

FIVTH PAPER: MANDATORY PARTICIPATION IN ASYNCHRONOUS LEARNING NETWORKS

1. INTRODUCTION 53

2. LEARNING ENVIRONMENTS 55

2.1 Construction of knowledge 55

2.2 Collaborative learning 56

2.3 Assessment of learning and examination 56

2.4 Asynchronous Learning Networks 57

3. MPE IN ALN 57

3.1 MOTIVATION 58

3.2 DESIGN 59

3.3 IMPLEMENTATION 59

4. TEACHER CENTERED EVALUATION 60

5. LEARNER CENTERED EVALUATION 61

5.1 EXAMINATION IN GENERAL (SURVEY 1) 61

5.2 MPE IN PARTICULAR (SURVEY 2) 62

5.3 INTERVIEWS 63

6. DISCUSSION 65

7. CONCLUSIONS 65

8. REFERENCES 66

Net-based Learning in Higher Education

1. Introduction

Net-based learning is a popular term for the use of computer networks to support learning. Net-based learning has been an important area of experimentation within the educational system for the last couple of years, and over the past year it has become an important area for the business world as well. For instance, the analyst firm IDC predicts that the market for net-based learning will have a growth-rate of 50%, and the CEO of Cisco has predicted that this is the next area to 'explode', like e-business. There are different approaches to net-based learning, building on different assumptions about knowledge and learning. This thesis is an exploration of net-based learning in higher education, building on non-traditional pedagogical ideas such as constructivistic learning, collaborative learning, problem based learning and formative assessment.

Higher education needs to change and improve. The fundamental assumptions, regarding the nature of knowledge and learning, that underly the educational system are overly objectivistic and mechanistic. A path-breaking exposition of how the educational system is fundamentally a bad place for learning is given by Lave and Wenger (1991). They illustrate how learning within the institutional context of the educational system is displaced from the cultural practice students are trying to become part of and master, and therefore socially embedded and situated knowledge related to that practice cannot be acquired (commonly this knowledge can be referred to as work experience). The socially embedded and situated knowledge which can be acquired is related to the educational system which the students are a part of (one could say they are becoming experienced students, teachers or researchers themselves). This is not to say that the educational system should be abandoned, only that we need to recognize the inherent limitations of learning displaced from actual practice, i.e. when learners are talking about a practice from outside rather than talking within it. Within the institutional context of higher education we can only go so far, not all aspects of knowledge and learning can be

supported. In this light, besides certain factual knowledge and general skills, the main learning within the educational system should concern general abilities, not so closely tied to a certain context of practice, such as critical thinking, abstract thinking, holistic thinking, group working, advanced reading and writing, awareness of subjects and practices, and reflection. Higher education is a place mainly for intellectual growth, not for becoming a professional; *"...learning in educational institutions should be about changing the ways in which learners understand, or experience, or conceptualise the world around them"* (Ramsden, 1992, p. 4).

Does this mean that efforts to improve the educational system are hopeless? No, although changing the educational system as a whole is an overwhelming task proven to be quite impossible over the last century, improving educational practice within the system is a more manageable task and this is an area of great importance (e.g, see Ramsden, 1992, for a discussion on the what, why and hows of improving educational practice) . Although the *"problems of schooling are not, at their most fundamental level, pedagogical"* (Lave & Wenger, 1991, p. 100), educational practice within the existing system can become better by improving pedagogical approaches and technology use. The improvement should concern a move from surface approaches that focus on content, knowledge memorization and reproduction, to deep approaches that focus on process, knowledge building and understanding (Norman & Spohrer, 1996; Ramsden, 1992; Schank, 1997; Schneiderman, 1998). Below a somewhat lengthy quote from Ramsden (1992, p. 60) is presented in order to let readers recognize the approaches to teaching and learning that dominate the educational system.

"The ubiquity of surface approaches in higher education is a very disturbing phenomenon…Surface approaches have nothing to do with wisdom and all to do with aimless accumulation. They belong to an artificial world of learning, where faithfully reproducing fragments of torpid knowledge to please teachers and pass examinations has replaced understanding…Once the material learned in this way is reproduced as required, it is soon forgotten, and it never becomes part of the student's way of interpreting the universe."

There have always been advocates for alternative learning models who have tried to inform and reform the educational system, but obviously with limited success since educational practice is still dominated by surface approaches to teaching and learning. However, over the last decade Internet technologies have emerged which offer possibilities not practically

available previously, such as net-based learning. The use of computer networks introduces new options to transform teaching and learning (Harasim et al., 1995). The meaning and societal impact of technology can certainly be debated but the standpoint in this thesis is that technology is a catalyst for change; *"the computer provides a powerful enabling technology for ideas that have been around for the past century"* (Norman & Spohrer, 1996). However, the use of IT will not alone improve educational practice. Substantial improvements require that IT use is accompanied by new teaching methods; instead of automating existing practice we should transform it (Leidner & Jarvenpaa, 1993; Leidner & Jarvenpaa, 1995). In other words, instead of replicating old practices with new tools we should create new cultures of learning in which tradition and new approaches meet (Nuldén, 1999). When using information technology to improve educational practice, it is important to use information technology in pedagogically well-grounded ways (Leidner & Jarvenpaa, 1995; Nuldén, 1999). By combining non-traditional pedagogical ideas with IT use, we can design innovative learning activities, and hopefully be more successful at transforming education than previously.

1.1 Research aim

The objective of this research is to improve the design of net-based learning activities. The context for the research is higher education, but the research is also relevant for other areas of organized education, e.g. high school and corporate training. The aim is to inform design approaches combining non-traditional pedagogical ideas with IT use. Also, the aim is to improve educational practice by introducing and using new approaches to teaching and learning in a concrete and applied way.

This thesis is an exploration of net-based learning in higher education, and the overall research question is:

How can the design of net-based learning activities in higher education be improved so that non-traditional approaches to learning can be successfully realized?

2. Theoretical background

In this section, different theories and ideas that are central to this research are presented and discussed. Before the theories are presented, it is important that the meaning and use of the theories is understood. First, we have a pragmatic and instrumental attitude towards different

theories of learning, and an extensive and nuanced discussion of the theories is beyond the scope of this research. We do however recognise that the nature of knowledge and learning is more complex than presented here and can be discussed more in-depth. Second, the theories are used not as recipes for design but rather they represent the fundamental assumptions about the teaching-learning process that underly this research. The notion of fundamental assumptions is explained below.

Improving education is not primarily about instructional methods, for example whether to use a problem-based method, or lectures, or hypermedia databases. Focusing on methods means to find the best technique for *how* to accomplish educational goals. However, methods are only useful when we know *what* we want to accomplish, i.e. when the use of techniques *"are directed by a clear awareness of key educational principles"* (Ramsden, 1992, p. 8). This has also been discussed in terms of the fundamental assumptions underlying our conception of the teaching-learning process, i.e. *"a fundamental difference in world view, disagreement at the level of grounding assumptions"* (Duffy & Cunningham, 1996). This implies that a discussion of the nature of knowledge and learning is difficult since the same expressions can have different meaning for persons with different frames of reference, thus much of the educational debate is at the level of slogan and cliché. Unfortunately this has an effect on not only discussions but also educational reform: *"...much of what is now being done in the name of maintaining academic standards is based on naive theories of learning"* (Ramsden, p 11). When designing or evaluating educational activities, it is important to be aware of ones assumptions about knowledge and learning since *"these assumptions lead to demonstrably different goals, strategies, and embodiments of instruction, even when there are some superficial similarities to instruction derived from different assumptions"* (Duffy & Cunningham, 1996).

2.1 Constructivistic learning

Constructivism is not an instructional method but rather a fundamental approach and mindset to learning (Cobb, 1994). The major assumption of constructivism is that *"individuals learn better when they discover things themselves and when they control the pace learning"* (Leidner & Jarvenpaa, 1995, p. 270). Learning is something that students do, not something that is done to them; *"whatever knowledge children gain they create themselves; whatever character they develop they create themselves"* (Wees, 1971, in Schneiderman, 1998). This implies that learners must be engaged and empowered in order to actively work with their

own learning and in a sense teach themselves. There are different views of constructivism but the general view is that *"(1) learning is an active process of constructing rather than acquiring knowledge, and (2) instruction is a process of supporting that construction rather than communicating knowledge"* (Duffy & Cunningham, 1996).

The debate on constructivistic learning has focused on learning situations in which students are constructing their own knowledge versus those in which knowledge is transmitted to them. This is a simplified type of discussion, that is useful only if one is aware of the values and meaning of each label. It is not so much that in some situations students are constructing knowledge and in others they are not. Rather, they are always constructing knowledge and the critical issue then becomes the nature or quality of that construction (Cobb, 1994). Transmitting knowledge means to treat knowledge as an object that can easily be communicated to a learner and assimilated in that learners understanding. This is often manifested through a course built around many lectures, much reading and a final detailed exam testing how much the students remember of the content. This approach to learning usually stimulates surface learning as opposed to deep learning.

A surface approach to learning means to participate in learning activities with the intention to primarily complete task requirements and meet the teacher's expectations (Ramsden, 1992). The result is usually that the fragments of information that were memorized to pass the examination are so unrelated to the learner's interests and level of understanding that they are quickly forgotten. Also, even if the information is very relevant and interesting the brain is not good at storing detailed facts unless we use them regularly. A deep approach to learning is not about storing detailed facts; it is about creating a holistic understanding consisting of interrelated facts, attitudes, beliefs, skills, etc. This is knowledge building in which understanding *"grows out of interacting with information and ideas – for example, reconstructing ideas, setting ideas within frameworks, viewing multiple perspectives on ideas, questioning implications of ideas, and posing theories or hypotheses about ideas"* (Harasim et al., 1995, p. 98). For knowledge building to be efficient, active involvement in the learning process is critical (Leidner & Jarvenpaa, 1993; Harasim et al., 1995).

2.2 Collaborative learning

Collaborative learning can be seen as an extension to constructive learning, and *"refers to any activity in which two or more people work together to create meaning, explore a topic, or improve skills"* (Harasim et al., 1995, p. 30). The basic premise is that *"learning emerges*

through shared understandings of more than one learner" (Leidner & Jarvenpaa, 1995, p. 270). The collaborative dimension enhances the individual construction of knowledge, i.e. collaborative learning is *"the aquisition by individuals of knowledge, skills, or attitudes as the result of group interaction"* (Kaye, 1992, p. 4).

Collaborative learning is not so much focused on cooperative work to more effectively complete a task, as it focuses on the creative tension between different perspectives, views and understandings. This tension stimulates a reflective process allowing learners to refine, confirm, or dismiss their understandings. The learners form a learning community where they are likely to learn as much from one another as from course materials or teachers. The learning process is focused on dialogue within the community where participants learn through *"offering up ideas, having them criticised or expanded on, and getting the chance to reshape them (or abandon them)"* (Rowntree, 1995, p. 207). It should be noted that collaborative learning does not always lead to positive effects on participants (Dillenbourg, 1996; Kaye, 1992). It can lead to conformity, process loss, lack of initiative, conflicts, compromise, etc.

2.3 Problem-based learning

Problem-based learning (PBL) is *"...a way of constructing and teaching courses using problems as the stimulus and focus for student activity. It is not simply the addition of problem-solving activities to otherwise discipline centered curricula, but a way of conceiving of the curriculum, which is centered around key problems in professional practice"* (Boud & Feletti, 1991). The problem is not a problem in a strict sense, rather it is a complex or problematic situation or phenomenon. It is a part of reality rather than a subject matter. PBL places the learner in a position similar to that of a researcher investigating a problem and gaining insights during the research process (Hård af Segerstad et al., 1997).

PBL is fundamentally a learner-centered, rather than a teacher-centered approach (Charlin et al., 1998), and as such it can be viewed as an implementation of the constructivistic and collaborative models of learning. There is a range of definitions of PBL but the common ground, or core principles, are: *"(1) the problem acts as a stimulus for learning; (2) it is an educational approach, not an isolated instructional technique, and (3) it is a student-centered approach"* (Charlin et al., 1998). Different PBL-based courses can differ in terms of degree of control over problem given to students, number of students working collaboratively, access to learning materials and resources, level of guidance from the teacher, etc.

Since PBL encourages open-minded, reflective, critical and active students it is a threat to teachers who strive to maintain total control over the content to be learned. After all, how can we guarantee that the students have learned what they are supposed to learn? Much of the control regarding what is learned is given to the students, but a common misinterpretation is that problem-based learning is giving all the responsibility to the students. On the contrary, the teacher's responsibility is to provide an appropriate learning environment and problem, which is crucial for the right learning process to occur. If the teacher chooses irrelevant problems, presents the problem wrongly, or is overly helpful, then true problem-based learning will not occur. Ownership of the problem is essential. If the students do not own the problem, they will spend their time figuring out what the teacher wants and wait for extrinsic cues from the teacher.

2.4 Assessment of learning and examination

The examination system has three functions: it is a system of recruitment, a pedagogical aid and an instrument of power (Kvale, 1975). As a system of recruitment, examination controls the access to studies and occupational positions. Those who pass the examination are given access to privileges not available for those who have not passed the examination. Examinations also have a pedagogical function, since they effectively steer the learning process. Learners will aim to learn what is to be included in the examination. Lastly, examination has a power function, i.e. the ability to control and influence people, as the recruitment to privileged positions in society is controlled and the thinking of the recruits is influenced. In this research we are mainly interested in the pedagogical function in order to improve the learning process.

The importance of examination as a pedagogical aid is widely recognized. For example, Ramsden (1992) claims that one of the most critical of all influences on students' learning are the assessment methods used. This powerful influence means that *"by changing the way we assess our students, we can shift from learning facts towards analyzing and discussing, and thereby, hopefully from surface learning towards deep learning"* (Berglund et al., 1998, p. 48). Students will study what they think will be assessed and graded; strategies for learning become synonym with strategies for passing the examination. In sum, if we wish to change educational practices, we should change the examination system. However, it should be noted that changing the examination system radically is related to changing the educational system as a whole and will encounter political problems. Kvale (1975) shows how *"a given system of*

examination reflects the basic contradictions of a society and also contributes to their maintaince", and thus society must change for a substantial change in the examination system to take place.

What is regarded as valid and useful assessment methods depends on the conception of knowledge and learning that serve as a frame of reference. An implication of viewing learning as constructed in the activity of the learners, i.e. constructivism, *"is that the individual can only know what he or she has constructed – and we cannot "know" in any complete sense of that term what someone else has constructed"* (Duffy & Cunningham, 1996). This means that a constructivist perspective denies the usefulness in trying to measure what is learned from a content perspective. Instead the focus shifts towards judging the quality of the learning process, i.e. if the process is good then learning probably occurs. This is in contrast to the dominating approaches to assessment, where the intention is to measure and control if learners have acquired the necessary knowledge, often with the use of written exams or term papers at the end of courses. Since the grades are an essential part of examination as a recruitment system, both students and educators are more comfortable if the product can be objectively graded. Unfortunately, this leads to one-dimensional measures that inevitably stimulate surface learning (Ramsden, 1992). However, grading should not necessarily be viewed as a bad thing, as it fulfills important functions in the educational system and also can be used as a powerful influence on students learning. Grading becomes bad when it is based on criteria that force students to use approaches to learning that lead to inferior outcomes, e.g testing memorization of atomic facts, de-contextualized formula, fragmented parts of information, etc. Grading using relevant and often more vague criteria, that stimulate deep learning, is usually by nature subjective and problematic. A constructivist perspective thus implies a shift from objective to subjective assessment and grading.

There are two types of assessment: summative assessment and formative assessment. Summative assessment is product-oriented and means to assess the outcome or product of educational activities. Formative assessment is process-oriented and means to assess the learning process itself, during the process so immediate improvement can be made. From a constructivist perspective, formative assessment becomes the most important. One understanding of formative assessment is scaffolding, which *"refers to the support provided so that the learner can engage in activities that would otherwise be beyond their abilities"* (Jackson et al, 1998). Scaffolding covers three categories: supportive scaffolding, reflective scaffolding, and intrinsic scaffolding. Supportive scaffolding is support for doing the task.

Reflective scaffolding is support for thinking about the task. Intrinsic scaffolding supports by changing the task itself, by reducing the complexity of the task and focusing the learner's attention.

3. Technological background

This section gives a brief overview of the technological background of this thesis. First, the field of computer supported collaborative learning (CSCL) is presented. Then a part of that field, interested in the notion of asynchronous learning networks (ALN), is presented.

3.1 Computer supported collaborative learning

Computer supported collaborative learning (CSCL) is a notion developed from the field of computer supported cooperative work (CSCW). Both fields are interested in using IT to support group interaction, but CSCL is focused towards supporting learning. The IT support for group interaction is often called groupware, and a taxonomy of different types of groupware applications has been developed within CSCW by Johansen (Johansen, 1988), and it is equally applicable for CSCL. The taxonomy, or 2-by-2 matrix, has the dimensions of time and place and outlines four different types of groupware applications:

1. Same time, same place: Meeting support, etc.

2. Same time, different place: Videoconferencing, etc.

3. Different time, different place: Email, etc.

4. Different time, same place: Support for shift work, etc.

CSCL is about *"collaborative learning - and how it might be supported by the computer"* (Bannon, 1994, p. 268). Computers can be used as an application which the learners interact with collaboratively, or an application that is a medium for collaborative learning. Furthermore, computers should not just support the learning process; they should be used in such a way as to affect the learning process per se and thereby provide new contexts in which collaborative learning might take place. However, sofisticated technologies might offer possibilities but are not alone a guarantee for sucessful learning processes: *"It is important to note that the technology per se is usually not the crucial issue, rather the social practices*

surrounding its use. Simply providing a physical or electronic connection between people does not guarantee that any collaborative learning will take place." (Bannon, 1994, p. 273)

3.2 Asynchronous learning networks

This thesis is about the use of asynchronous learning networks (ALNs). The reason for using the term net-based learning in this introduction and the title of the thesis is that it is a popularly more used term and more commonly known both outside and within the research community. An ALN is a collection of computer network technologies used to support collaborative learning (Harasim, et al., 1995). These technologies are for example bulletin board systems, electronic mail systems, news and topic services, computer conferencing, directories, customized educational environments, computer networks such as the Internet, and the World Wide Web. Different technologies are combined to create an electronic environment to support learning for distributed participants working at different times (alternative 3 in Johansen's taxonomy presented above). The key ingredient of an ALN is the capability for learners to learn anywhere and at anytime and to be part of a community of learners (Bourne, 1997). The interaction between learners is mainly asynchronous but can be supplemented with synchronous chats, face-to-face meetings, etc. ALNs have been used as an enhancement to traditional courses, as the primary teaching medium for courses, or as a forum for knowledge networking in non-educational settings (Harasim, et al., 1995).

Besides offering convenient access, the strength of ALNs is that the asynchronous nature of the medium slows down interaction, giving learners time for reflection, and for preparing ideas, questions, and comments, to be shared with other learners. Also, since communication is text-based, learners are forced to articulate their opinions and thoughts, something that can be difficult but rewarding. From a social perspective, there is no "turn-taking" in discussions so all participants can write new comments whenever they want, and there is more equality of participation compared to face-to-face discussions (Hiltz & Wellman, 1997). This enables more learners to participate in the discussions. However, the use of technology can be discouraging for some and create difficulties; for instance those who are good at typing and are computer literate will have an advantage. Also, the feeling of belonging in the community of learners, i.e. if the learner feels like an outsider or insider, affects participation and quality of interaction (Wegerif, 1998). The importance of social issues in ALNs is elegantly stated by Hiltz & Wellman (1997, p. 47): *"though the classroom is virtual, the relationships and the learning it supports are real"*.

There is certainly potential in using information technology for various types of distance education. However, it is not a miracle-medicine and recent studies have highlighted the negative aspects, such as students' frustrations in web-based distance education (Hara & King, 1999). Also, the flexibility in time may render learners and teachers to work more hours than previously, since work is never far away, and so one must be able to handle a situation where *"online courses can encrouch on the rest of one's life"* (Rowntree, 1995, p. 215). Acknowledging the recent critisism and problematisation of ALN-based learning is important since most of the research up to date has been very positive and perhaps overly optimistic.

4. Research approach

This thesis is a work in the Swedish scientific discipline called informatics, which has recently been reformed under the name of 'the new informatics' (Dahlbom, 1996). Informatics is *"a theory and design oriented study of information technology use, an artificial science with the intertwined complex of people and information technology as its subject matter"* (Dahlbom, 1996, p. 29). The focus is the use of information technology, but instead of just studying the use of technology, it is interested in changing and improving that use. The design orientation of the discipline, that follows from its future orientation, is very important. It is interested in designing better IT-artifacts and practices; the ambition is *"to put that technology to good use, acting both on the technology and on the organisation of its use"* (Dahlbom, 1996, p. 45). In this research, the informatics approach is applied to the field of net-based learning.

4.1 Method

The approach, or strategy, adopted in this research is action research. An action research approach was deemed the most suitable for several reasons: (1) teacher resistance against new approaches to teaching (e.g. Schneiderman, 1998) meant that it would be difficult to find an appropriate case to study which could also be influenced, and (2) most importantly, in order to get first hand experience of the role of teachers, students and the use of technology, we needed to be in the center of action. A third reason is that it was convenient from a practical perspective.

Action research can address complex real-life problems and the immediate concerns of practitioneers (Avison et al., 1999). Classical action research starts from the idea that if you want to understand something well you should try changing it (Easterby-Smith et al., 1991).

Action research is *"applied research where there is an attempt to obtain results of practical value to groups with whom the researcher is allied while at the same time adding to theoretical knowledge"* (Galliers, 1992, p. 152).

Action research encourages researchers to experiment through intervention and to reflect on the effects of their intervention and the implication of their theories (Avison et al., 1999). The aim is to gain knowledge through making deliberate interventions in order to achieve some desirable change in the organizational setting (Vidgen and Braa, 1997). In action research, the researcher wants to try out a theory with practitioneers in real situations, gain feedback from this experience, modify the theory as a result of this feedback, and try it again (Avison et al., 1999). This is the cycle of action research and one or more cycles can be completed before the goals are achieved.

In action research the researcher takes an active role as an interventionist. This places a considerable responsibility on the researcher when objectives are at odds with other groupings (Galliers, 1992). The two major risks of action research are (1) not being able to handle the ethical responsibility as a researcher and (2) not following the tenets of action research, thus engaging in an ordinary consulting activity.

4.2 Research site

This thesis is based on an action research project conducted at the School of Economics and Commercial Law, Göteborg University, Sweden. The situation at the school is similar to other higher education institutions, i.e. they have to deal with an increasing number of students and resources are scarce. The access to computer labs is relatively good and many students have personal computers with Internet access in their homes.

The School of Economics and Commercial Law comprises the following departments: Business Administration (including Accountancy, Managerial Economics, Marketing, and Management and Organization), Economics (including Economics and Finance), Economic History, Human and Economic Geography, Informatics, Law, and Statistics. With an academic staff of about 300 teachers and researchers, the departments cooperate in the provision of undergraduate and graduate degree programs. Annual enrollment at the undergraduate levels is well above 4000, while more than 300 students register in graduate courses.

A mainly net-based introductory course in informatics was given, as a part of this research project, for second year undergraduate business administration students in the autumn 1998. This course is described in the individual papers.

5. The five papers

This section summarizes the five papers that constitute the body of this thesis. The first paper of the thesis explores facilitating in ALNs and identifies the need for additional functions in the software, i.e. technology support. The second paper elaborates further on the idea of technology support and some brief suggestions for design are made. In the third paper we discuss the changing role of teachers and relate this to transformation of the educational system. The fourth paper focuses on examination from a teacher perspective. The fifth paper, finally, extends the fourth paper by focusing on examination from a student perspective.

5.1 First Paper: ”Activity Visualization and Formative Assessment in Virtual Learning Environments”

In this paper we focus on facilitating from a learning process perspective, as opposed to a topic perspective, in ALNs. We discuss the role of facilitators, the need for feedback about the students learning processes, and the characteristics of ALNs. The main argument is that ALNs lack functions to visualize the activities of students in a way that gives facilitators continuous and updated activity awareness. Without this technology support it is difficult for facilitators to help students. Several difficulties experienced by the facilitators in the Informatics course are presented.

5.2 Second Paper: ”Visualizing Learning Activities to Support Tutors”

In this paper we elaborate further on the ideas of technology support in ALNs to support facilitators and students. We do so by giving examples of such tools: ActivityLines, individual history, and email notification. Experiences from the Informatics course highlight situations when technology support is needed, how the implemented functions were percieved and can be improved. The main argument is that visualizing learning activities is a promising approach to improve the possibilities of social interaction in ALNs. The paper gives implications for the design of ALNs.

5.3 Third Paper: ”The new online teacher”

In this paper we discuss the changing role of teachers and the educational technology they must learn to use meaningfully. The basic rationale is that IT acts as a catalyst for changing the educational system, and this change is accompanied by a non-traditional conception of knowledge and learning; thus the environment and situation that teachers must master is new and different. We outline the need for methodological support and education for teachers. Also, important issues in transforming education in general are highlighted.

5.4 Fourth Paper: ”Mandatory Participation as Examination”

In this paper we highlight the importance of examination in education and propose mandatory participation as the primary examination criteria in ALN-based courses. We argue that mandatory participation as examination is suitable in ALNs for several reasons. The rationale is that collaborative learning emphasises active participation, ALNs support active participation, and thus mandatory participation as examination is viable. Based on the teachers accounts and observations, experiences related to mandatory participation as examination in the Informatics course are presented.

5.5 Fifth Paper: ”Mandatory Participation in Asynchronous Learning Networks”

In this paper we extend the fourth paper by focusing on how the students percieved mandatory participation as examination in the Informatics course. We present the results of a survey focused on the categories fairness, convenience and learning. The results indicate that the students did not percieve interaction and dialogue with each other as learning. In search for explanations to why the course was not valuable from a learning standpoint, the paper ends by presenting interviews with four students and a discussion of their comments.

6. Results

The overall research question in this thesis has been:

How can the design of net-based learning activities in higher education be improved so that non-traditional approaches to learning can be successfully realized?

The following is a description of the main results of this thesis. They represent both design proposals and findings that inform design, related to the overall research question.

- Activity Visualization, an approach to improve social awareness in ALNs. The need for advanced technology support for teachers in ALNs is obvious and so far only fragmented and limited support is available in commercial software.

- Mandatory Participation as Examination, a model of examination for net-based learning. Research on examination in net-based learning is scarce and often the issue is only implicitly addressed. We contribute to putting examination on the research agenda.

- An empirically based understanding of net-based learning in higher education. For instance, we highlight the problematic nature of net-based learning and thus much research seems overly optimistic. Problematizing and critical accounts of experiences with net-based learning are scarce, to this we make a contribution.

- Being action research, one result is improvement and change of the educational system; at least a small part of it. This can be manifested in changed mindsets of students and teachers, and more concretely in additional net-based learning initiatives. Even though the latter has been limited there have been some more initiatives at the university, however mainly tied to our close environment.

7. Further research

The ideas of Activity Visualization to increase social awareness in asynchronous learning networks can and should be further developed. This may be a crucial factor to enable examination and assessment to be performed with high quality. This research is related to the increasing attention given to social awareness in web-based environments. This is a hot issue today in fields such as social navigation, CSCW and virtual communities.

Critical research on net-based learning is needed since much work to date has been overly optimistic. Some of our assumptions in this research have been too optimistic, but still we have had a somewhat critical perspective in this thesis. Problematizing accounts of both learning outcomes and technology use are useful in order to be able to make substantial improvements.

Since this work was conducted, e-learning as a concept and term has become popular and commercially interesting. E-learning is a buzzword for net-based learning, although many commercial e-learning solutions are more focused on delivering information than supporting

dialogue among learners. Increasing attention on e-learning means that net-based learning will find its way to work settings. Therefore, further research is needed regarding the use of net-based learning in such a setting, something that is scarce today. This is probably due to problems and requirements of such a setting, for example that workers give priority to other activities. It is easier to implement the ideas in an educational setting.

8. References

Avison, D., Lau, F., Myers, M. and Nielsen, P. A. (1997). Action Research. Communications of the ACM, Vol. 42, No. 1 (January 1999).

Bannon, L. J. (1994). Issues in Computer Supported Collaborative Learning. In O'Malley, C. (Ed.). Computer Supported Collaborative Learning, Springer-Verlag, Berlin: 267-281.

Berglund, A., Daniels, M., Hedenborg, M., and Tengstrand, A. (1998). Assessment to Increase Students' Creativity: Two Case Studies. European Journal of Engineering Education, Vol. 23, No. 1, 1998, 45-54.

Boud, D. and Feletti, G. (1991). (Eds.). The Challenge of Problem-Based Learning. Kogan Page Limited, London.

Bourne, J. R., McMaster, E., Rieger, J., and Campbell, J. O. (1997). Paradigms for On-Line Learning: A Case Study in the Design and Implementation of an Asynchronous Learning Networks (ALN) Course. Journal of Asynchronous Learning Networks 1(2): 38-56.

Charlin, B., Mann, K., and Hansen, P. (1998). The Many Faces of Problem-Based Learning: A Framework for Understanding and Comparison. Medical Teacher, Jul98, Vol. 20, Issue 4, pp. 323-330.

Cobb, P. (1994). Constructivism in Mathematics and Science Education. Educational Researcher, Vol. 23, No. 7, p. 4.

Dahlbom, B. (1996). The New Informatics. Scandinavian Journal of Information Systems, 8(2): 29-48.

Dillenbourg, P., Baker, M., Blaye, A., and O'Malley, C. (1996). The evolution of research on collaborative learning. In Spada, P. & Reimann, H. (Eds.). Learning in Humans and Machines. Towards an interdiciplinary learning science: 189-211.

Duffy, T. M. and Cunningham, D. J. (1996). Constructivism: Implications for the design and delivery of instruction. In Jonassen, D. H. (Ed.). Handbook of research for educational communications and technology. New York, Macmillan Library Reference.

Easterby-Smith et al. (1991). Management Research: An Introduction. Sage Publications.

Galliers, R., (1992). Choosing information system research approaches. In: R. Galliers, editor. Information Systems Research: Issues, Methods and Practical Guidelines. Blackwell Scientific Publications, Oxford.

Hara, N. and King, R. (1999). Students' Frustrations with a Web-Based Distance Education Course. First Monday, volume 4, number 12 (December 1999). http://www.firstmonday.org/issues/issue4_12/hara/index.html

Harasim, L. Hiltz, S. R., Teles, L., and Turoff, M. (1995). Learning Networks: A Field Guide to Teaching and Learning Online. The MIT Press, Cambridge, Massachusetts.

Hiltz, S. R. and B. Wellman (1997). Asynchronous Learning Networks as a Virtual Classroom. Communications of the ACM 40(9): 44-49.

Hård af Segerstad, H., Helgesson, M., Ringborg, M., and Svedin, L. (1997). Problembaserat lärande (Problem-based learning). Liber, Stockholm.

Jackson, S. L., Krajcik, J., and Soloway, E. (1998). The Design of Guided Learner-Adaptable Scaffolding in Interactive Learning Environments. CHI '98, Los Angeles, ACM Press.

Johansen, R. (1988). Groupware: Computer Support for business teams. New York, The Free Press.

Kaye, A. R. (1992). Learning Together Apart. In Kaye, A. R. (Ed.). Collaborative Learning Through Computer Conferencing, Springer-Verlag, Berlin.

Kvale, S. (1975). Examinations: From Ritual Through Bureaucreacy to Technology. Social Praxis 3(3-4), pp. 187-206.

Lave, J. & Wenger, E. (1991). Situated Learning - Legitimate peripheral participation. Cambridge University Press.

Leidner, D. E. and Jarvenpaa, S. L. (1993). The Information Age Confronts Education: Case Studies on Electronic Classrooms. Information Systems Research 4(1): 24-54.

Leidner, D. E. and Jarvenpaa, S. L. (1995). The Use of Information Technology to Enhance Management School Education: A Theoretical View. MIS Quarterly 19 (3): 265-291.

Norman, D. A. and Spohrer, J. C. (1996). Learner-Centered Education. Communications of the ACM, Vol. 39, No. 4, April 1996.

Nuldén, U. (1999). e-ducation. Doctoral dissertation, Göteborg University.

Ramsden, P. (1992). Learning to Teach in Higher Education. Routledge, London.

Rowntree, D. (1995). Teaching and learning online: a correspondence education for the 21st century?. British Journal of Educational Technology 26 (3): 205-215.

Schank, R. (1997). Virtual Learning: A Revolutionary Approach to Building a Highly Skilled Workforce. New York, McGraw-Hill.

Schneiderman, B. (1998). Relate – Create – Donate: a teaching/learning philosophy for the cyber-generation. Computers & Education, 31, pp. 25-39.

Vidgen, R. and Braa, K. (1997). Balancing interpretation and intervention in information system research: the "action case" approach. In Proceedings of IFIP 8.6: Information Systems and Qualitative Research, Philadelphia, May 31 - June 3, 1997.

Wegerif, R. (1998). The Social Dimension of Asynchronous Learning Networks. Journal of Asynchronous Learning Networks 2(3): 34-49.

First Paper

Activity Visualization and Formative Assessment in Virtual Learning Environments

Urban Nulden and Christian Hardless

1. Introduction

Teaching, tutoring and assessing students becomes radically different in a virtual learning environment than in a traditional classroom (Harasim, Hiltz et al., 1995; Hiltz and Wellman, 1997). The more activities that are 'net-based,' the more technology-based support is required for the educator. Computers free educators to spend less time on direct instruction, but do not diminish the role of the educator. Instead, they can change the role towards guiding and helping students to put information into context. See for instance Laurillard (1993) and Ramsden (1992) for a discussion about the role of the educator. The process of guiding students is an ongoing struggle and requires thorough understanding of the learning process. For tutors and teaching assistants, virtual learning environments introduce a whole new situation.

2. Asynchronous learning networks

A common way to build virtual learning environments is through the use of asynchronous learning networks (ALN). Implementations of ALN utilize different tools for computer mediated communication (CMC). In this way, ALN can be understood as an IT infrastructure supporting educational activity. This infrastructure includes email, bulletin boards and news-groups, synchronous chat systems, computer conference systems, group decision systems, and more recently the World Wide Web (WWW) (Hiltz and Wellman, 1997). The central pedagogical idea in an ALN is collaborative learning at the time and place of the individual learner's convenience (Bourne, McMaster et al., 1997). ALN's are best at enhancing educational activities when they serve as a way to create a feeling of a group of people learning together, and to structure and support carefully planned collaborative learning

activities. ALN is an integration of CMC tools that in many ways are used to slow down the dynamic interaction, thus providing opportunity for reflection.

There are problems in using ALN's. Anonymity and issues related to the fact that people do not meet face-to-face introduce initial problems with many ALN based courses. Many students find it easy to postpone attendance when they are busy with other things. This can easily turn into falling seriously behind. It is also shown that despite good intentions when structuring a computer conference there is an extensive risk of information overload. Early and enthusiastic activity in the beginning of an ALN based course might result in some students overloading others by writing and posting voluminous and numerous messages.

3. Thematic modules

Net-based technologies such as CMC and ALN's give educators the opportunity to structure education in new forms. Thematic Modules (TM) is a structuring philosophy designed to overcome some of the problems outlined above (Nuldén, 1999). Central in TM is that learning is most effective when the students are actively engaged in the process. In other words, constructivism which posits that people can only understand what they have themselves constructed (Leidner and Jarvenpaa, 1995). Meaningful learning takes place when students can reflect on what they know, and when they can communicate it to others. Therefore, in TM, written collaboration among the learners is essential. The basic principles of TM are a course divided in a number of modules. Each module is a self-contained unit covering a topic presented by an expert in that field. The expert, in this case a scholar or practitioner, presents a field or topic during a two hour lecture with the purpose of creating an interest among the students. That is, the aim of the lecture is to start the week long module. The lecture ends with a more or less structured assignment depending on the lecture style of the expert. Understanding the lecture as the explicit starting point for a week long learning activity instead of a regular lecture is a twist to many of the experts and students. The class is divided into groups of about 15 students. Each group has a Teaching Assistant (TA) who is responsible for subtly guiding the students in the ALN when there is need for intervention, i.e., facilitating the discussion. Every module has the same basic structure: The module starts with a lecture, which introduces a topic, and ends with one or several problems that the groups are to explore further. They then work with the assignment in groups in the ALN. TA's play a crucial role in creating the sense of a community and collaboration among the

learners as well as provide guidance in the topic of the module. Thematic modules have many things in common with problem based learning (PBL). For instance, in PBL the starting point for the learning process is a problem the learner wishes to know more about. TM and PBL share the notion of teaching as initiating and managing student activity, not as transmission of knowledge.

4. Formative assessment and scaffolding

The structure of a virtual learning environment with ALN and TM will not in itself ensure interaction among the students and a constructivistic learning process. Providing an alternative learning environment means different roles and changed responsibilities. In TM's it is the responsibility of the TA's, and ultimately the course coordinator, to *"create conditions in which understanding is possible"* (Laurillard, 1993). The most critical condition is assessment. If the assessment procedure is not congruent with educational goals, the assessment can drive the learner in an antithetical direction (Swanson, Case et al., 1991). The way the students are assessed will be the greatest influence on what learning strategy they adapt for the course (Ramsden, 1992).

In TM, learning and assessment are integrated in the doing process, which is expanded to consist of the whole course. Formative assessment focuses on the learning process. Compare this to summative assessment, which is the grading of students' performance in relation to predefined goals. Formative assessment, on the other hand, is dialog and feedback. Loss of interaction among students and educators is a serious potential risk, especially if the educators have no, or limited, feedback about the students learning processes. Timely and individualized feedback is crucial for the learning process. This is often referred to as scaffolding which is the support provided to learners so they can participate in activities otherwise beyond their abilities. Scaffolding provided in traditional educational settings is a well-established means of supporting learning. Instructional software, to some extent, provides individualized support by providing more advanced functionality available as the learner develops expertise. Virtual learning environments have inherent characteristics, which affect the awareness of the learning processes. The asynchronous nature of the learning activities leaves educators and students without a complete picture of the activities, progress and usage patterns. In a sense the involved persons become blind. Without a good awareness of the activity that is going on

in an ALN, i.e., activity visualization, formative assessment and scaffolding becomes unprecise and random.

5. Experience and technical solutions

The structuring philosophy of TM and ALN was used in a two-credit points introductory course in Informatics for second year undergraduates at a Business School. This course was selected for partly practical reasons, mainly the number of students and the demographics. Eighty five students, equally men and woman, and an average age of 23. Five Informatics graduate students were engaged as TA's for the course. Each TA was assigned as responsible for facilitating a group of approximately 15 students. The TA's received a short introduction to the content of the course, the philosophy of TM and what was expected of them as facilitators in the groups. Their role can be summarized as assisting the group in developing new insights and connecting this with previous knowledge. The TA's were asked to facilitate the topic content discussion and knowledge development, but also to facilitate the group process and ensure active participation of all members of her group. The TA's clearly received the instruction that they should not teach. An Activity Visualization (AV) prototype with very limited functionality was designed and implemented. The activity in the ALN was presented as plain text without visual enhancements. The functionality included: Automatic notifications of activity via email, number of hours since every person last visited the ALN, most recent posts by each person, most recent posts by each TA, and a summary view of new messages.

An evaluation of the ongoing process in the course was conducted. Time was allocated for interviews with all the TA's to, more in-depth, discuss problems and difficulties connected to their role in the course. The interviews were informal and focused on the questions: *"What is difficult in being a teaching assistant in a virtual environment?"* and *"What kind of support would you like to get from the technology?"* It should be noted that there is a continuous dialog between the TA's and the course coordinator, but the structured interviews were helpful to systematize the experiences of the TA's. Also, one of the TA's agreed to keep a diary for the duration of the course. The diary was then used as one source of data during a mid-course evaluation of the teaching assistant role.

Analyzing the interviews and the diary, the following problems and difficulties become clear: Tutoring in the virtual environment was more difficult than expected according to all five

TA's. When and how to intervene in the group-discussion was perceived as problematic. Especially individual support was difficult to give because of uncertainty about individual progress. Also, in traditional tutoring activities, being a tutor is easier, because in ALN's it is very easy to become one of the participants rather than the tutor with responsibilities. The interviews also suggest that if the assignment presented at the lecture starting a module is structured as well defined questions, facilitating the discussion is quite different to a lecture ending with a more delicate assignment. Structured questions cause the activity in the group to focus more on answering of the questions, e.g. providing solutions, than discussion. On the other hand, too open and free discussion topics, generate frustration in the student groups, e.g., *"is this what we should learn?"* Students and TA's tend to have a personal discussion style which eventually causes discussions to become routinized and boring. The dynamic interaction within groups could possibly be improved if the groups were re-mixed each module. The TA's clearly found it easier to facilitate and guide the discussion from a topic perspective than facilitating the actual process.

It is the characteristics of the virtual learning environment which brings about some of these difficulties. Fortunately the characteristics also give the possibility to design technical solutions to address the problems. Analyzing the content of the discourse can be done manually but this is tedious and boring work that is not a realistic option. Instead the computer is a perfect candidate for this task. For instance, Xin and Fisher (1998) have used computerized analysis of usage patterns in learning environments to evaluate and improve usability of the software. In the research presented in this paper the aim is different and the focus is on the need for continuous and updated activity awareness. As discussed above, AV is the process of systemizing online content and presenting it in user-friendly graphical format for all participants, both students and TA's. The technical solution is a combination of different approaches and the results give individuals the opportunity to view activities, progress, and usage patterns from various perspectives. This is a possible tool to decrease the online blindness discussed above.

6. Discussion and further research

This paper has discussed the need for activity visualization as support for formative assessment in virtual learning environments. This was evaluated in a course structured as thematic modules. The preliminary results of analyzing the limited data collected through

interviews suggests that there is a need for technical support and AV is a promising approach for this. The results from this study provide direction for further research on both the role of the TA's in virtual learning environments, and on the design of technology support for this role.

The AV prototype is currently being enhanced to include more functionality and to present results in a visual form. Some of the future functionality will be: Analysis of message lengths to reveal usage patterns and relationships, message counts in relation to time, usage patterns showing complete overview of when, where, and how to give a feel for what's happened, possibility to give individual feedback as opposed to public messages, and mood indicators to improve understanding of context. Practice as well as research on the educator role in virtual learning environments is still in its infancy. There is a need for new methodologies with integrated supporting technology. This research has suggested one such possible integration of methodology, Thematic Modules, and technology, Activity Visualization.

7. References

Bourne, J. R., E. McMaster, J. Rieger and J. O. Campbell (1997). Paradigms for On-Line Learning: A Case Study in the Design and Implementation of an Asynchronous Learning Networks (ALN) Course. Journal of Asynchronous Learning Networks 1 (2): 38-56.

Harasim, L., R. Hiltz, L. Teles and M. Turoff (1995). Learning Networks - A Field Guide to Teaching and Learning Online, The MIT Press. 376.

Hiltz, S. R. and B. Wellman (1997). Asynchronous Learning Networks as a Virtual Classroom. Communications of the ACM 40 (9): 44-49.

Laurillard, D. (1993). Rethinking University Teaching - A framework for the effective use of educational technology, Routledge.

Leidner, D. E. and S. L. Jarvenpaa (1995). The Use of Information Technology to Enhance Management School Education: A theoretical View. MIS Quarterly 19 (3): 265-291.

Nuldén, U. (1999). Thematic Modules and Asynchronous Learning Network: Designing introductory courses. HICSS-32, Maui, Hawaii.

Ramsden, P. (1992). Learning to Teach in Higher Education. London, Routledge.

Swanson, D. B., S. M. Case and C. P. M. e. van der Vleuten (1991). Strategies for Student Assessment. The Challenge of Problem Based Learning. D. Boud and G. Feletti. London, Kogan Page Limited: 260-273.

Xin, M. & Fisher, B. (1998). Analysis of learning environments using Web server log files. Proceedings of ICCE ’98, 2, 222-229.

Second Paper

Visualizing Learning Activities to Support Tutors

Christian Hardless and Urban Nulden

Abstract

This paper describes difficulties when tutoring in virtual learning environments. Activity Visualization (AV) is proposed as technology support for greater awareness and understanding of learning processes. Evaluations based on rich experiences from a course have been conducted. The results are positive confirming a need for technology support and indicating that AV is a promising approach.

1. Introduction

One type of virtual learning environment is an asynchronous learning network (ALN). ALNs are often built using different tools for computer mediated communication (CMC), for example email, bulletin boards, and computer conference systems. An ALN is a teaching and learning environment designed for anytime/anyplace use and the central pedagogical idea is collaborative learning (Hiltz & Wellman, 1997).

Learning processes and the role of educators and students in virtual learning environments are radically different from traditional classrooms (Harasim et al., 1995). The role of educators can change towards facilitating and guiding students instead of transmission of knowledge. This paper uses the term *tutor* to indicate this role in a virtual learning environment.

The way students are assessed will be the greatest influence on what learning strategy they adapt for the course (Ramsden, 1992). In other words, the assessment procedure must be congruent with the learning philosophy. Formative assessment focuses on the learning process and means dialog and feedback. The point is to provide support, i.e. scaffolding, for learners so they can participate in activities otherwise beyond their abilities.

2. Tutoring in virtual learning environments

The responsibility of the tutor is thus to provide timely and individualized feedback regarding the learning process, not the topic content. This is a difficult task in virtual learning environments often putting tutors in unfamiliar territory (Harasim et al., 1995). In a traditional classroom body language reveals when and how the tutor should intervene but in a virtual learning environment reliance on body language is not possible. The asynchronous nature of the learning activities and the electronic environment leaves involved persons without a complete picture of the activities, progress and usage patterns. This lack of awareness means that tutors in a sense become ”blind”, and that formative assessment and scaffolding becomes un-precise and random. In this paper awareness means up to date knowledge of ongoing activities taking place as part of the learning process. It is clear that some technology support is needed to enable greater awareness and understanding of the learning processes.

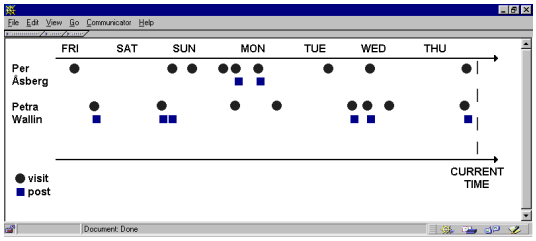

Figure 1. ActivityLine

3. Activity visualization

This paper proposes Activity Visualization (AV) as technology support to reduce the blindness discussed above. AV means using information from the ALN to visualize aspects of the learning process, thus giving persons the opportunity to view activities, progress, and usage patterns from various perspectives. The approach in this research is broad, using a combination of various techniques to show events and activities. These techniques can be more or less visual depending on the purpose, and the purpose can range from simply presenting atomic data to visualizing complex and dynamic usage patterns and relations. The overall result should be greater awareness and understanding of the learning process. AV is intended to support the learning process in a positive manner, not to be used for control. Therefore it is essential that it is available to both tutors and students. The remainder of this section gives three examples of various techniques:

3.1 ActivityLines

The mockup screenshot in figure 1, i.e. an *ActivityLine*, shows visits and posts over time for each person. This can also be aggregated to show group activity. Each visit, i.e. login, is represented by a dot and each post by a square. This overview makes it easier to spot trends and anomalies. For instance, if students are visiting without posting they might be stuck and need feedback. Or if no visits are made there is no reason for feedback, something which may be impossible to know without AV. Just because the discussions are empty does not mean students need help. ActivityLines are similar to other visualizations such as *LifeLines* (Plaisant et al., 1996) and *educational software evaluation* (Xin & Fisher, 1998). However, the differences are apparent: The previous concerns a much less dynamic process which is situated in the real world as opposed to events taking place in electronic environments. The latter is used to post-course evaluate the usability of educational software but ActivityLines, and AV in general, is used for continuous feedback during the process, not after.

3.2 Individual history

It is difficult to pick out each individuals contributions in discussions due to the large amount of contributions from the collective user community. An individual history, consisting of a list of recent messages per individual, gives an alternative view of discussion contributions.

3.3 Email notification

Asynchronity provides opportunity for reflection but keeps persons unaware of new activity. In order to create some sense of synchronity messages posted in the conference system are also sent to participants as emails, i.e. *email notification*.

4. Evaluation

The evaluation was based on a course totalling two weeks of full-time studies and stretching over a period of ten weeks. The course involved 85 students, five graduate students as tutors, and limited AV-support. The implemented AV-support consisted of email notification and individual histories for students and tutors, but not ActivityLines. In the conference system used, totally 51992 hits and 3839 posts were registered during the course. While the numbers in themselves do not provide us with much information, they indicate the great number of activities taking place during a course.

AV was evaluated from two perspectives: First, the AV-support implemented and used in the course, and second, the imagined future AV-support. The findings are the following:

4.1 Experiences of tutoring

- Individual support was difficult to give because of uncertainty of individual progress. Especially, quiet students are easy to ”forget” and feedback is often based on group progress.

- The tutors found it more difficult to facilitate from a process perspective than from a topic perspective. When and how to intervene in the group-discussion was percieved as problematic.

- It was difficult to know which students had participated in which discussions and which students had not been present/active. Since active participation in discussions was mandatory in the course this was partly an issue of control.

- Some tutors manually went through discussions and kept notes about every single student and activity. This was a boring and time consuming labour.

4.2 Comments and ideas on AV

- Besides the implemented AV-support mentioned above, a simple overview of time passed since the last login for each person was also used in the course until it turned out to be corrupt. The need for this support was apparent after it’s removal (often we realize how much we need things when they are lost).

- ActivityLines were welcomed by the tutors, when discussing the idea. Marking special outside events such as exams and holidays, was suggested to give further understanding of the students situation.

- The individual histories for students discussed above was too limited since it only showed the five most recent messages. A complete history is needed.

- The individual histories for tutors was appreciated by the tutors as a source of inspiration because tutors too can get stuck and need feedback.

- The volume of email notifications can overload users, especially when messages are irrelevant such as off-topic discussions. Some kind of filtering system is needed to ensure that relevant notifications receive proper attention.

5. Discussion and future work

AV as technology support is a promising approach to partly remove some difficulties when tutoring in virtual learning environments. However, many difficulties are not technology-related and require methodology support for the tutor role but that is beyond the scope of this paper.

Virtual learning environments introduce limitations and difficulties but also unique possibilities. Tracking individual activities is potentially controversial since the risk of violating personal integrity is considerable. Therefore the possibilities must be used carefully with little emphasis on control and great emphasis on positive support. Future work concerns further development of the mentioned AV-support, exploration of various new techniques to visualize aspects of the learning process, and research on methodology support for the tutor role.

6. References

Harasim, L., Hiltz, S.R., Teles, L., and Turoff, M. Learning Networks: A Field Guide to Teaching and Learning Online. The MIT Press, Cambridge, Mass., 1995.

Hiltz, S. R. and Wellman, B. Asynchronous Learning Networks as a Virtual Classroom. Commun. ACM 40, 9 (Sep. 1997), 44-49.

Plaisant, C., Milash, B., Rose, A., Widoff, S., and Shneiderman, B. LifeLines: Visualizing Personal Histories. Proc. CHI 96, ACM, New York. 221-227.

Ramsden, P. Learning to Teach in Higher Education. Routledge, London, 1992.

Xin, M. and Fisher, B. Analysis of learning environments using Web server log files. Proceedings of ICCE' 98, Vol. 2, 222-229.

Third Paper

The New Online Teacher

Günther Dippe and Christian Hardless

Abstract

Computer supported collaborative learning puts new demands on teachers who therefore will need to take on new roles and use new technology in education. In this paper we discuss the changing role of teachers and the educational technology they must learn to use meaningfully. We also outline the need for methodological support and education for teachers. Finally, we discuss the changes in a larger perspective concerning the educational system in general.

1. Introduction

In this paper we discuss the emergence of a new teacher role in education: the online teacher. There is a need for greater understanding of this role as the education system is slowly realizing the potential in using information technology (IT) with a learner-centered approach.

IT has acted as a catalyst to bring force to the alternative learning theories which over the years have challenged the traditional teacher-centered learning philosophy which currently dominates education. The demand that IT should be used more in education is no longer only driven by the Government and the private sector but also by the parents of pupils and students. With better-integrated and more reliable services on the Internet there is a strong tendency toward utilizing the net as a premium choice for net-distributed teaching and as a learning tool. The traditional role of the teacher is swiftly changing with the use of the net and new demands for efficient communication and in-depth learning among participants call for a deeper understanding of online learning. The teachers conceptualization and understanding of these different processes and how they affect his/her role and thereby govern the outcome of the goals strived for, must be investigated further and also involve multiple academic disciplines.

An example of the change at hand is ITIS: The Swedish government is investing SEK 1,5 billion during the period 1999 – 2001 with a possible SEK 500 million in 2002 in IT infrastructure and an extensive competence program for teachers (see http://www.itis.gov.se). 60 000 teachers are offered a free home computer if they participate and follow a pedagogic-focused course of using IT integrated in their teaching. Approximately 1200 mentors (who mostly are teachers) will participate in a specifically designed course on how to guide and support some 8000 teacher groups. It is recommended that these mentors or guides support groups at other schools and even in other municipals than their own schools which will demand extensive use of the Internet for communication with their groups since they don't get more than some 40 hours of guidance per group.

The remainder of this paper is organized in 5 sections: First, the teacher's changing role is discussed. Second, we introduce the learning environment. Third, we look at how teachers can be supported by methodologies and education. Fourth, the coming of the new online teacher is related to transforming education in general. Finally, we draw some conclusions for the future.

2. The teacher's changing role

The strong force in society to rationalize and make work more effective has also influenced the educational system. There is a belief that human understanding, reflection, learning and comprehension may be seen upon as any production process. This has resulted in poorer educational work being done and it has even had negative influence on research since its' results are rated in relation to usefulness within the market. We tend to get less and less time for reflection and viewing different perspectives. This makes traditional occupations as teacher more of a measurable productive unit than an occupation for promoting learning and growth among students. This shallow and unreflective way of educational premises will certainly backlash and in the end affect the society itself. Teachers must be aware of these factors affecting their occupation and it is of great importance especially when using IT as an aid in their work.

It is believed that the traditional teacher role as the informant and linker of knowledge will change to a more supporting and guiding role to create favorable conditions for student learning. The dominating learning philosophy is based on the assumption that learners should be stimulated to absorb knowledge, i.e., objectivism. Knowledge is transferred from the

expert to the learner by lecturing, careful structuring of information, and control of pace. In this way the role of the teacher becomes that of an instructor. Collaborativism on the other hand views learning as a learner-centered activity. Learners share knowledge and create an individual understanding of reality (Leidner & Jarvenpaa, 1995). The learners control the pace and content, and empowerment, engagement, and active participation in dialog is critical for learning. The role of the teacher becomes that of a facilitator who supports rather than directs learners. This is what we mean by "the new teacher".

What is the responsibility of the new teacher? The way students are assessed will be the greatest influence on what learning strategy they adapt for the course (Ramsden, 1992). In other words, the assessment procedure must be congruent with the learning philosophy. Therefore, the teacher responsibilities should focus on assessment as this will have the largest impact on student learning. Formative assessment focuses on the learning process and means continuous dialog and feedback. This can be viewed against assessment based on the product of learning, for example an essay. One way to practice formative assessment is scaffolding, that is providing support for learners so they can participate in activities otherwise beyond their ability (Jackson et al., 1998). The responsibility of the teacher is thus to provide timely and individualized feedback regarding the learning process, not the topic content. This is a difficult task in virtual learning environments often putting teachers in unfamiliar territory.

3. The Learning Environment

Information technology has enabled teachers to enhance and innovate educational activities. By designing a learning environment that supports the desired learning process, favourable conditions for learning are created. Below we discuss the characteristics of such a learning environment, both concerning technology and use.

3.1 Asynchronous Learning Network (ALN)

A common term for the kind of learning environment we are concerned with is asynchronous learning networks (ALN). An ALN is a net based learning and teaching environment where possibilities and problems are different from traditional classrooms. A distinct characteristic of an ALN is the notion of anywhere/anytime learning. Traditional education takes place within a rigid time-space framework. ALNs free both the student and the teacher from this. We all have different biological clocks, which govern our daily rhythm. The individual may then decide when and also where the learning should take place as long as the goals for the

course are fulfilled. ALNs are often built using different tools for computer mediated communication (CMC), for example email, bulletin boards, computer conference systems, group decision support systems, and the WWW (Hiltz & Wellman, 1997). See figure 1 for an example of an ALN.

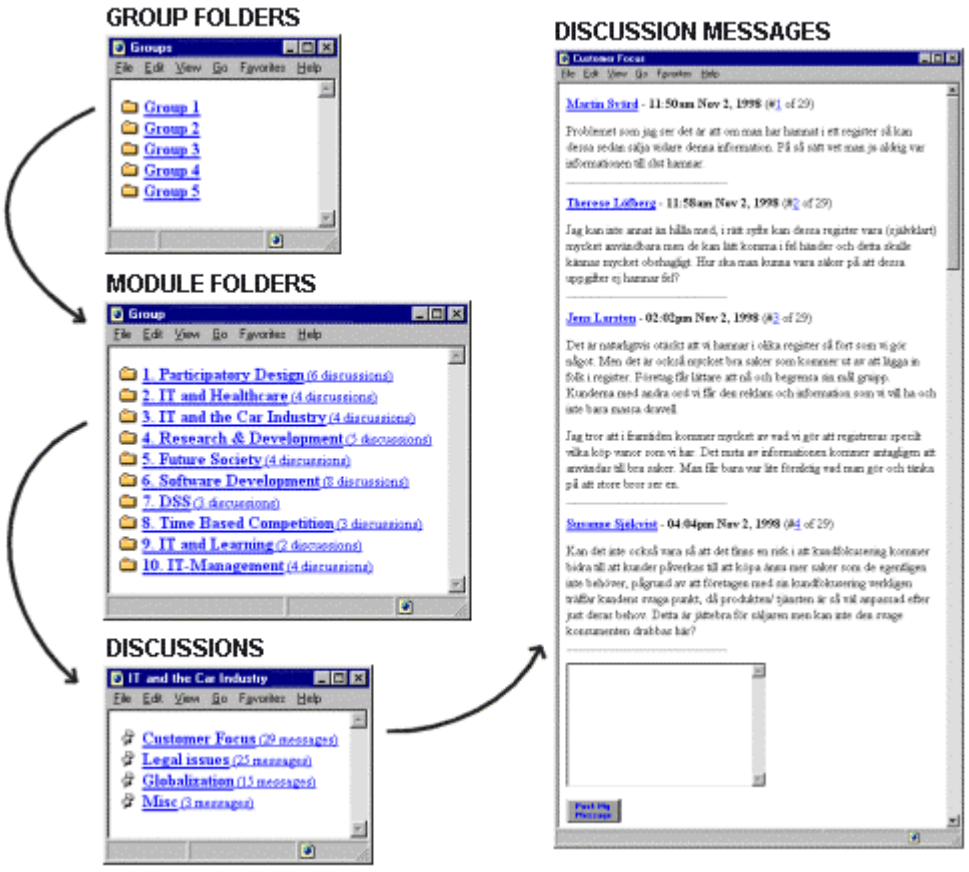

Figure 1. A conference system as the main part of an ALN

In an ALN, learners form a community engaging in collaborative learning at the time and place of the individual learner's convenience (Bourne et al., 1997). By slowing down interaction, learners are given time for reflection, and ideas, questions, comments, etc. can grow and mature before being shared with other learners. Articulating and making opinions and understandings explicit is a learning process in itself, and knowing that ones work will be available for other learners, i.e. peer-to-peer review, is motivating and brings out high efforts. Active participation in learning activities, for example discussions, is crucial for successful learning; this is proclaimed in most research on ALN based collaborative learning.

Much of today's teaching with the aid of the Internet takes place via e-mail and different discussion groups. To a lesser extent videoconferencing and teleconferencing are being used.

The bandwidth of the Internet still seems to be a limiting factor with the exception of local networks. As technology evolves and bandwidth increases the use of for example videoconferencing will become more widespread and place yet new demands on the teacher. However, text based communication has unique advantages and will therefore not be fully replaced by videoconferencing, only used in different situations.

Whatever technology is used to support learning activities, the teachers and learners need to understand the new medium. The ways we communicate via text on the Internet has little resemblance with the letter writing used in snail-mail communication, and messages tend to be more concise and even abbreviated. Misunderstanding and incorrectly interpreting messages becomes a far greater problem, especially since the communication to a much greater extent takes place between participants who don't use their native language. In an educational framework this calls for a pre-understanding of the associated problems and ways of handling different situations. With mailing lists and discussion groups we often see moderators but in education their role must be less prominent so the communication and learning among the participants are not greatly disturbed.

3.2 Visualizing Learning Activities

Even for a skilled online teacher the learning environment complicates matters. In an ALN there is a lack of social context, overview and cues which reveal the need for teacher intervention (for example body language). The teacher effectively becomes "blind" since many aspects of the learning process are missing, or rather out of sight.

An ALN needs tools which provide social context and increase teachers understanding of the learning process (Hardless & Nuldén, 1999). The tools should provide continuous support during the learning process, not afterwards. A broad approach combining different technologies and visualizations, both graphic and text based, is useful for teachers.

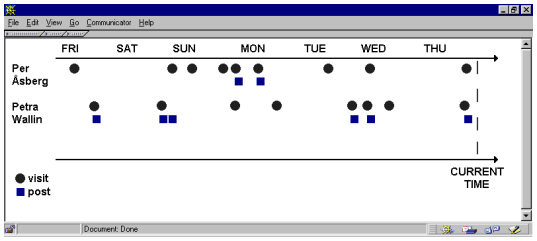

Figure 2. ActivityLines

An example of a tool showing social context is an ActivityLine (figure 2). The teacher gets an overview of activities in the ALN over time. Dots represent visits and squares represent posts. In this case it shows individual activity but it can also be aggregated to show group activity.

3.3 Social interaction

Humans are social creatures and the importance of direct communication and presence of ones comrades is of direct relevance for efficient use of IT in different contexts. Teachers and learners need to understand the limitations and possibilities of IT supported interaction. Distributed learning using IT to carry social interaction is often viewed as non-social and face-to-face communication is seen as the most complete interaction form. For instance, it has been shown that not even direct contact via videoconference has the ability to bypass face-to-face individual contact (Sven Lumsden, personal communication, 1997, GBG University).

However, research has also shown that ALN based learning is very social and can indeed convey feelings, mood, etc. It is a matter of how we use the medium and how well we understand its characteristics. Hiltz & Wellman (1997) discuss how IT can support relationships between learners. They say that *"due to its reduced social presence, the Internet will never replace face-to-face meetings for engendering and nurturing primary group relationships."* The lack of social presence can actually be a positive factor as learners often are more uninhibited, creative and blunt. If primary relationships have already been established the medium can support these: *"The Internet today is being used in the same was as letters and, later, the telephone were used to sustain traditional community relationships"*.

A very important social factor to consider is the equal opportunity for learners to participate. Wegerif (1998) discusses the problems concerning insiders and outsiders in online learning. There is always a risk that learners are divided into two camps where one consists of the insiders; those comfortable with the medium, up-to-date with learning activities, and accepted by the group. The other camp, the outsiders, are learners who for some reason, for example not being as active as others, feel left behind. This is a situation that the teacher must recognize and try to deal with.

Since the ascent of the new IT, society has gradually adopted to the notion of the individuals freedom to solve their work tasks regardless of space and to a lesser extent regardless of time. If work tasks are not increased to exceed the currently adopted 8 hour workday, this freedom has in quite a few cases led to occupations where distance work is accepted as part of the

regular in-office work. This gives, among others, families, greater opportunities take active part in raising their children. Travelling times to and from office diminish and are thereby available for other activities. The concept of 9 to 5 work is gradually replaced by an 8 hour-within-the-day concept. This flexibility in time may also render teachers to work more hours than previously, since work is never far away, and so one must be able to handle a situation where *"online courses can encroach on the rest of one's life"* (Rowntree, 1995).

4. How can we support the new teacher?

Teaching with a learner-centered approach is very difficult. This is further complicated by the novelty of the medium and inexperience in teaching in such an environment. Online teachers need plenty of support in order to be successful in their new role. We believe they need both methodologies and education.

4.1 Methodology for online teachers

Online meeting places with asynchronous learning give the teacher unique possibilities to delegate learning and responsibilities among the students. E-mail, mailing lists, discussion boards, workspaces, groupware, etc and possibilities to share different kinds of information and the relative freedom of where and when participation occurs, gives the individual new concepts of learning and how communication can take place with fellow students. It's a win-win situation both for the teacher and the student. A stringent methodology which primarily sets a clear framework for the course and also gives the students a clear view of how different services are intended to be used within the course is a must since situations may occur where no other communication than via the above mentioned services will be at hand. The grading criteria set for the course must take into account the new methodology and technology used.

In our minds we often think of the teacher role as that of an instructor. Being a facilitator is one thing but acting as one is another. It is difficult to view learning as a process instead of product. Facilitators often unintentionally focus on the topic content instead of the learning process, especially inexperienced facilitators. We are trapped in our experiences from a traditional school system based on objectivism. The new online teacher thus needs both guidelines for how to support the learning process and experiences which challenge their conception of the teacher role.

4.2 Educating new online teachers

Because the role of the new online teacher is very different from what teachers and people in general are familiar and comfortable with, both experienced and inexperienced teachers need to be educated. In designing a course for these mentors it is of paramount importance that it reflects the actual methodology and pedagogics used later by the mentors with their groups.

Teaching online is often a new and difficult experience and guidelines are needed. Guidelines for online teaching usually focus on characteristics of the online medium, such as 'length of messages', 'overloading discussions', 'frequency of participation', etc. Guidelines for collaborativist learning are usually very general, such as 'provide opportunity for reflection', etc. These guidelines are all useful but quite limited in the support they provide for inexperienced online teachers. They provide good theory but little help in practice. It is impossible to formalize the facilitation practice. How can we then find alternatives to the abstract guidelines available? Case studies and anecdotes have always been a powerful means to understand practice. Therefore realistic examples of online teaching might be a means to provide support and inspiration for the online teacher.

5. Innovating education

Today we face a situation where the educational system is trying to transform and to some extent adopt the kind of IT-enhanced education described in this paper. There is great uncertainty concerning the transition from small scale experiments to large scale implementations of learning models which are a radical change to the current system. Educational institutions such as the Open University, University of Jyväskylä, and University of California have all experimented and conducted research about online teaching but these and more course innovations all share one thing in common: They affect limited parts of the institution and rarely affect the core of education.

5.1. Problems with using IT in education

In the educational system, which unfortunately has been valid from preschool education to university teaching, it has long been believed that learning how to use the technology itself is of minor importance and hence very little focus has been paid to the actual skills demanded for using the technology. This has caused much frustration among teachers and a relatively slow development of utilizing the possibilities of computer-supported education.

Malfunctioning computers, networks and network services are also big problems and tend to inhibit the use of IT in the classroom. These factors have resulted in the prime use of the computer as a typewriter and not as a tool for communication, information search and learning aid in a broader sense.

Gross underestimation of costs of support, both of the technology used and teachers' need of assistance and competence development, have also contributed to the slow development of using IT in the educational system.

The teacher has often less knowledge or at least different knowledge than their students in utilizing the Internet and its vast possibilities of information search and communication. Furthermore the teacher is often more reluctant to adopt and use new technologies than their students are. To optimize the settings for learning the teacher must develop new strategies, learn new pedagogical concepts and also overcome the drawback of his/her own expectations of being the supreme source of knowledge. This insight can for many teachers be a rather harsh awakening, and since the teacher often works solitary it may result in a more or less attenuated personal crisis. We strongly believe that teachers must work in a collegial framework where support and competence may spread in a natural way. This calls for a more active role of the pedagogical leadership among headmasters, deans and other school leaders.

5.2 IT as a catalyst for improvement

Understanding the impact of the technology used on pedagogical concepts may lead the teacher to explore and develope new insights concerning learning and learning processes. The base for understanding how learning is an in depth understanding of pedagogics together with a scientific approach. The teacher's development, both as a theoretician and as a practitioner, may be revived by using IT since the use of the technology raises new questions which in turn call for new concepts and perspectives.

It is a well known that nt + oo = eoo (new technology + old organization = expensive old organization). This can easily be rephrased to nt + op = bop (new technology + old pedagogics = bad old pedagogics) in education. The impact of IT as a force for changing the current established traditions in pedagogics and didactics is little understood since the tool (today IT) always has been of minor importance compared to the pedagogics and didactics used and applied by the teacher or the lecturer. We need to rethink the way these new tools influence and act as a prime force on the way we teach and also how we conceptualize

learning both from an individuals point of view and from the group perspective. The tool itself has the power to force us into widening our thinking how teaching and learning processes take place and thereby acting as a prime force for developing a new, or at least greatly, modified pedagogic and didactics. This will have great impact in teachers' education and also on opening up new research fields that hopefully tie the actual teaching closer to the researchers' results of different studies.

6. Conclusion

A new teacher role is knocking on the door of the educational system. Clearly, the difficulties and complexity of such a role, suggest that the use of IT and new learning models must not be taken lightly. Teachers need support in the form of methodology and education, and can be expected to grow, rather than jump, into the new role.

7. References

Bourne, J. R., McMaster, E., Rieger, J., and Campbell, J.O. (1997). Paradigms for On-Line Learning: A Case Study in the Design and Implementation of an Asynchronous Learning Networks (ALN) Course. Journal of ALN 1 (2): 38-56.

Hardless, C. and Nuldén, U. (1999). Visualizing Learning Activities to Support Tutors. Extended Abstracts of CHI '99, Pittsburgh, ACM Press.

Hiltz, S. R. and Wellman, B. (1997). Asynchronous Learning Networks as a Virtual Classroom. Communications of the ACM 40 (9): 44-49.

Jackson, S. L., Krajcik, J., and Soloway, E. (1998). The Design of Guided Learner-Adaptable Scaffolding in Interactive Learning Environments. CHI 98, Los Angeles, ACM Press.

Leidner, D. E. and Jarvenpaa, S. L. (1995). The Use of Information Technology to Enhance Management School Education: A Theoretical View. MIS Quarterly 19 (3): 265-291.

Ramsden, P. (1992). Learning to Teach in Higher Education. Routledge, London.

Rowntree, D. (1995). Teaching and learning online: a correspondence education for the 21st century?. British Journal of Educational Technology 26 (3): 205-215.

Wegerif, R. (1998). The Social Dimension of Asynchronous Learning Networks. Journal of ALN 2 (1): 34-49.

Fourth Paper

Mandatory Participation as Examination

Christian Hardless and Urban Nulden

Abstract

This paper discusses examination, focusing on the possibilities available in ALN based learning. ALN is an acronym for asynchronous learning networks and in this research this means a web based learning environment supporting anywhere/anytime learning. The notion of mandatory participation in learning activities is argued to be more viable in ALNs rather than traditional classrooms. Mandatory participation as the primary examination criteria is used and evaluated in a higher education ALN based course, resulting in several key experiences which are presented and discussed. These experiences contribute to a richer understanding of problems and difficulties involved in ALN based courses.

1. Introduction

The post-industrial society requires, more than previously, skills and abilities such as communicating and working well with other people, complex problem solving, reasoning towards deep understanding, and being able to express perspectives and reflect on others' perspectives. When information is abundant in society the goal of learning is no longer memorization of facts. Instead we learn to learn, and engage in a life-long learning process. As a result, learner-centered education has emerged as a contender for the dominating learning philosophy (Norman and Spohrer, 1996).

Constructivism and collaboratism are two related learning models which are learner-centered. Constructivism denies the existance of an objective reality; reality is a unique world-view related to each individual's mind. Rather than absorbing transferred knowledge, knowledge is created, or constructed, by each learner. The collaborative model of learning differs from constructivism by focusing on learning as a result of interaction among individuals. Through discussion and information sharing learners construct a shared understanding, and also

improve communication and listening skills. See for instance Leidner and Jarvenpaa (1995) for a more detailed discussion on different learning models.

Collaboratism stresses active participation in the learning process. Passive learners do not learn, so learners must be motivated and engaged, and instructors should support rather than control the learning process. Course organization and incentives must facilitate and promote active participation. It is easy to assume that students naturally should participate actively, but reality is complex and students often choose other learning strategies.

Perhaps the most important influence on learning strategies and outcomes is the examination procedure. Courses have an official curriculum, but the examination procedure constitutes an unofficial hidden agenda. For meaningful learning to occur, examination, i.e. the hidden agenda, must be congruent with the learning philosophy (Ramsden, 1992). If examination procedures in practice promote different learning strategies than intended, official curriculums have little, or no effect.

This research attempts to bridge the gap between collaborative learning and examination. Net based learning environments offer possibilities unavailable in traditional classrooms, possibilities which are discussed below, and make active participation a realistic option for examination criteria. We propose mandatory participation as the primary examination criteria in net based collaborative learning. The idea of mandatory participation was used to design a higher education course which was realized and used for the evaluation. 85 students participated in the course, where the authors were teaching assistant and course coordinator respectively, and key experiences from the evaluation are presented to give a rich understanding of problems and difficulties involved in net based collaborative learning.

2. Asynchronous learning networks

For the remainder of this paper, instead of using the term net based learning environment we will adhere to the established concept of asynchronous learning networks (ALN). An ALN is a net based learning and teaching environment where possibilities and problems are different from traditional classrooms. A distinct characteristic of an ALN is the notion of anywhere/anytime learning. ALNs are often built using different tools for computer mediated communication (CMC), for example email, bulletin boards and newsgroups, synchronous chat systems, computer conference systems, group decision support systems, and most recently, the World Wide Web (Hiltz and Wellman, 1997).

In an ALN, learners form a community engaging in collaborative learning at the time and place of the individual learner's convenience (Bourne et. al., 1997). By slowing down interaction, learners are given time for reflection, and ideas, questions, comments, etc. can grow and mature before being shared with other learners. Articulating and making opinions and understandings explicit is a learning process in itself, and knowing that ones work will be available for other learners, i.e. peer-to-peer review, is motivating and brings out high efforts. Active participation in learning activities, for example discussions, is crucial for successful learning; this is proclaimed in most research on ALN based collaborative learning.

Learning processes and the role of educators and learners in ALNs are radically different from traditional classrooms (Harasim et. al., 1995). An important issue to remember is that ALN based learning is a social process, or in other words: *"though the classroom is virtual, the relationships and the learning it supports are real"* (Hiltz and Wellman, 1997). Social skills, status, preferences, traditions, etc. affect the success of individuals and groups. See for instance Wegerif (1998) for a discussion on the social dimension of ALNs.

The next section will discuss the difference between participation and presence, after which we suggest an integration of learning and examination relying on the unique possibilities offered by ALNs.

3. Participation versus presence

A somewhat controversial discussion about participation versus presence highlights some weaknesses of traditional classrooms and strengths of ALNs. To be present is simply to passively attend group sessions, and to participate is to actively contribute to group sessions. Attendance does not imply active participation and this is where traditional classrooms are, we claim, weak. In a traditional classroom learners can attend, not be active participants, and seemingly participate. In an ALN one cannot just attend; lurkers are invisible and to be visible participation, that is interaction with other learners, is necessary.

Participation versus presence is more than an issue of control; it is also an issue of equality. Learners who try to actively participate can be hampered by various social factors. Whereas in traditional classrooms learners must be allowed into the discussion before speaking, in an ALN learners are part of the discussion at all times; there is no slow turn-taking which keeps ideas and comments on the sideline. Time passes quickly in real-time discussions and many learners have difficulties to find ideas under such extreme time pressure. In ALN based

discussions ideas can grow over a longer time period and also, considering that contributions are situated in a discussion context, the moment where the contribution is suitable is longer. In traditional classrooms discussions change direction rapidly and the right moments are brief. Other social factors are for instance gender issues, nervousness and self-confidence, and language differences. ALNs do not always have a positive impact on equality, for instance the permanent nature of text in discussions can be considered uncomfortable and limiting as opposed to casual talks.

Considering the importance of active participation for collaborative learning the discussion of participation versus presence leads us towards a starting point for the evaluation: The notion of mandatory participation in learning activities is argued to be more viable in ALNs rather than traditional classrooms.

4. Mandatory participation

This paper has discussed why ALN based courses are well-suited for active participation in learning activities. This makes it viable to consider active participation as the criteria of examination. Current educational practices intend for examination forms to support, or at least not hinder, learning, but in practice the examination forms are unaligned with the learning philosophy. An alignment of learning philosophy and examination, thus making examination an integrated part of the learning process, is suggested: Collaborative learning stresses active participation; ALNs support active participation. Therefore this paper proposes mandatory participation as the primary examination form in ALN based courses.

Mandatory participation seems to offer an integration between examination and learning, which is in line with the notion that one cannot separate examination from learning. Demanding active participation is a bold and radical move considering that in most cases participation in ALN based discussions is optional and examination consists of assignments such as essays at certain times.

As discussed above anywhere/anytime learning is a key issue for ALNs. Work wherever and whenever you want but participation is mandatory. It sound like a paradox but it is not. Learners are used to mandatory attendance in physical spaces but mandatory participation, not only attendance, in virtual spaces is very different, or at least new. Certainly voices will be raised about inequality concerning computer access. We however consider the time has come when computers are widely available, like any other transportation means. Large investments

have been made to increase the number of campus computers and many people have computers at home. Just like learners living far away from campus are required to take care of transportation to campus, we require that learners take care of computer access issues. As it is accepted with mandatory lecture attendance, we say: If you cannot participate, then why are you taking this course?

This of course sounds harsh and perhaps naiv but it is a main ingredient if participation is to be mandatory. In the next section we will discuss the evaluation of the concept of mandatory participation in an ALN based course.

5. Evaluation

The idea of mandatory participation guided the design of an ALN based course. Mandatory participation is a continuous form of examination where learners must be ”reasonably” active throughout the course. Therefore, learning activities must be evenly spread over the course duration; learners can be more or less active over time so the total participation determines examination outcome, not large assignments at certain times. In order to achieve this flexibility in participation the course was structured using thematic modules (TM).

TM is a structuring philosophy which divides the course into several self-contained units (Nulden, 1999). This is different from traditional modular structuring where a large topic area is divided into subtopics small enough to digest for learners, like chapters in a book. In TM each module introduces a separate issue or problem, like tiny islands in a vast ocean of knowledge. Every module has a well defined beginning and ending. Because each module is self-contained learners can be more or less active in different modules according to interest and outer circumstances, as long as the total participation is satisfactory.

An introductory course in Informatics, given for undergraduate business administration students, was designed on the basis of mandatory participation and TM. Each module was initialized with a, hopefully inspiring and challenging, two hour lecture. The rest of the week-long module consisted of discussion in groups in the ALN and an end-of-module summary provided closure. The course lasted for 10 weeks, that is covering 10 modules, and awarded 2 credit points. 85 undergraduate students were entered in the course and they were divided into five groups, each having a teaching assistant (TA) to facilitate and support online discussions. One of the TAs’ responsibilities was to inform the course coordinator about students who were not fullfilling examination requirements. The course coordinator would then judge the

students effort and take full responsibility for any final decision to fail the student. Deciding if a student's participation fullfilled the examination requirements was in some cases difficult. Some limited tools, i.e. visualizations, were available to make it easier to understand each individuals participation level but these were apparently not enough. The issue of technology support for TAs is however beyond the scope of this paper but is an important area for future research.

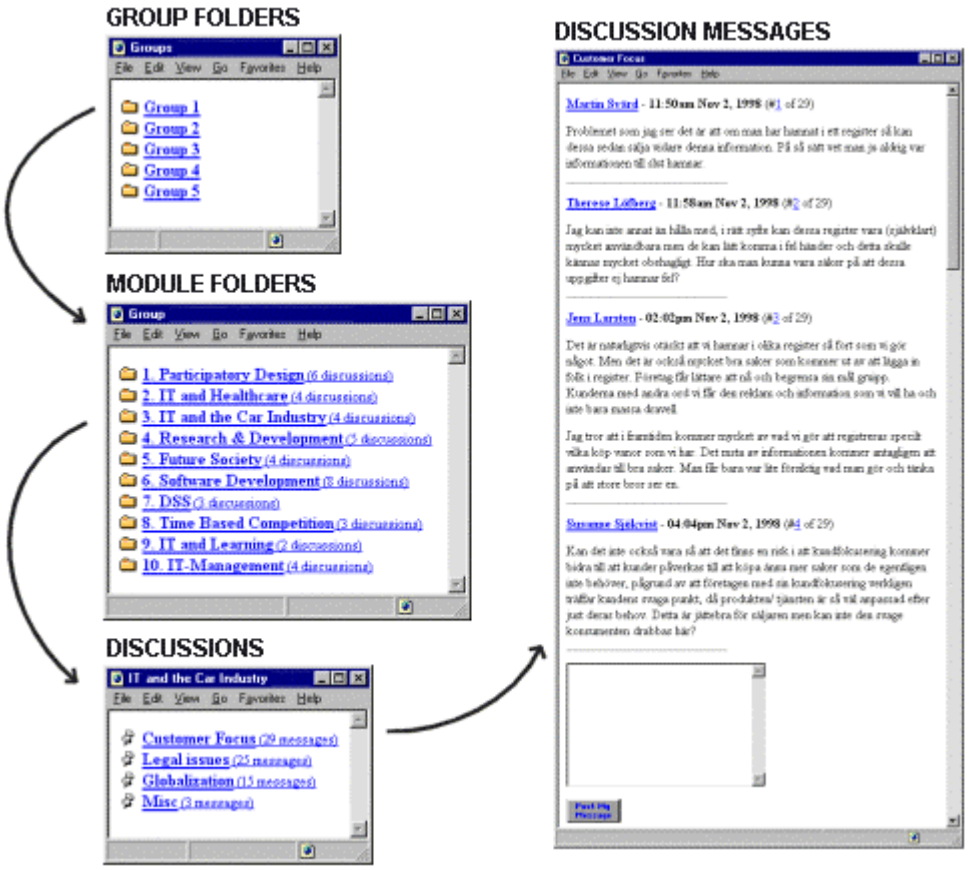

Figure 1. The ALN

The ALN used for the course was very structured, ordered, and hierarchical. Figure 1 shows screenshots of the ALN interface. Each group had a separate area, i.e. folder, and within the group folder there were 10 folders, one for each module. During a module the group would create appropriate discussions in the current module folder. Discussions are containers for messages and, as we can see in figure 1, new messages are appended to a vertical list of existing messages. New messages were also sent to the students with e-mail as a notification service. In this case the ALN was highly-structured but this is not a requirement for TM in general. TM is a flexible structuring philosophy and can be adjusted to different settings and intentions.

Half-way through the course the course coordinator and TAs thouroughly discussed students' participation and five students were judged to be non-participant and as an effect of being failed they were no longer allowed to access the ALN. For the second half of the course none of the remaining students neglected participation and so they all passed the primary examination. Having passed the primary examination they were allowed to complete an end-of-course assignment determining the final grade: pass or high pass.

In practice, mandatory participation as the primary examination criteria turned out well. There were some complaints on problems in accessing computers, as expected causing a conflict with the mandatory participation demand, but this was a minority of students and they managed alright despite this handicap. Many students wanted us to reserve campus computers for them regularly but we did not since this conflicts with the notion of anywhere/anytime learning. It should be noted that the learners were judged leniently; only very apparent cases of low participation were failed. This does not mean students passed for free; only that, because determining resonable participation is difficult, we decided to rather pass than fail the uncertain cases.

6. Experiences

We will share some of our experiences, or anecdotes if you wish, from the evaluation which are related to mandatory participation. These experiences serve to give some depth in the understanding of problems and difficulties involved in ALN based learning and mandatory participation.

6.1 New and different

The ALN based course proved to be in sharp contrast with regular courses which the students had experienced previously. The shift from teacher-centered to learner-centered education was somewhat of a revolution.

Technology-wise it was certainly a change in that the course was ALN based but students were relatively familiar with computers and the Internet. The students were given a brief manual for the system, a short demonstration, and an optional half-day workshop. The few computer novices learned quickly and some of them remarked afterwards *"oh, was it that simple…"*.

The revolution concerned the learning philosophy. Students were not used to collaborative learning, unstructured tasks, open-ended discussions, and the notion of producing knowledge for themselves rather than the teacher. They were hampered by a textbook focus and lack of initiatives. Roughly they were asking: *"What are the exact examination criterias and where is the final written exam?"*

Many of the lecturers, especially those who were teachers, were also stuck in the traditional view on learning. Their lectures were not percieved by the students to serve as a motivating starting point. Understanding the lecture as a starting point instead of an overview or summary is a difficult change process. Interestingly, the most appreciated lectures were those performed by professionals from the industry.

For the course coordinator and TAs it too was a new and challenging situation. We had little previous experience of this new form of learning and knew it would be a difficult process, for us and foremost the students. Therefore we decided to have a very positive and generous attitude, by for example having extended office hours. Introducing the ideas to the students was not trivial. Convincing them to commit and engage in collaborative learning was problematic and is a key issue for the success of ALN based courses.

6.2 Off-topic discussions

We identified two cases where students engaged in off-topic discussions. The first concerns non-serious discussion, i.e. topics not related to the course. The second concerns students posting to serious discussions but with the intent to pass examination, not contributing to the learning process.

Examples of non-serious discussions were sports discussions, tv-show discussions, and music discussions. Each of the five groups created about two such discussions and, unlike the serious discussions, these lasted throughout the course. These discussions were popular judging by the volume of messages they recieved, for instance one discussion about icehockey recieved 140 messages. The tone of voice was different compared to serious discussions; more relaxed. One, unintentional, problem was that all messages were also sent as e-mails to participants. The volume of e-mails was already high enough without off-topic messages so this became a source of annoyance. This leads us to claim that non-serious discussions should be kept totally separate from serious ones; not so much where they are placed but more importantly avoiding interference issues such as ours.

The second type of off-topic discussions concerned students feeling the pressure to say something in order to pass the examination. Because we had an open-minded and friendly attitude towards the examination many students dared to admit posting not to contribute to discussions but to meet examination criteria, that is they posted just for the sake of it. Some joked about the need to say something serious quickly in the beginning of the module before everything was said. Especially during the first modules students tended to post similar messages, rather than building on each others contributions. Another reason for low-quality messages was the problems in accessing computers. The affected students simply had to do everything at once when they found a computer, that is read, think, and post. There was no room for reflection since leaving the computer and coming back later to post was unthinkable.

6.3 Mature and evolve

Above we discussed how new and different ALN based collaborative learning was for students. During the course we also noticed how students changed attitudes, learning strategies, etc. We feel that at first many students had difficulty seeing the point in collaborative learning but over time some students revised their attitude to this way of learning and realised that one can learn from interaction with other learners. Of course, not all students were convinced and 10 weeks is a short time to change ones perception of what learning is. We do however believe that the new experience will have started a thinking process within most students which will lead to critical and reflective examination of the learning they participate in later. Even if they did not see the point of collaborative learning directly, they might think differently in a year or two.

Also, students at first had trouble with the mandatory participation criteria. As one TA expressed it: *"Initially my students thought mandatory participation meant they had to be constantly present in the ALN. This caused frustration and they said: 'Be there all the time? This can't be? We have other things to do!'. Gradually they realised what we meant and eventually they started working as intended with about one visit per day to update themselves, reflect, and post messages."*

6.4 Teaching assistant frustration

One of the TAs' responsibilities was to stimulate students who were inactive and not participating in a satisfactory manner. The first difficulty was to decide when a student was not reasonably active. All TAs had different personal styles but none wanted to appear bossy or bad tempered, so pushing students was difficult, especially when faced with a borderline

case of inactivity. This gives us the second difficulty; how to approach students and give them a friendly push. Another practical issue is being able to contact students. Sometimes reaching inactive students was impossible because they did not participate in the discussions and we did not always have their emailaddress. A TA should always be able to reach all of her students.

The TAs mainly tried to facilitate discussions and help students reach higher levels of understanding. Sometimes a TA might say something really interesting and challenging, only to be disappointed when no reaction was triggered. Either the students were not interested in the new discussion option or they simply lacked the experience to build on feedback which was too advanced. Giving appropriate feedback is a very complex issue and it is further complicated by the fact that the students all have different backgrounds, experiences, and preferences.

7. Conclusion and future work

This paper has introduced the idea of mandatory participation as examination in ALN based courses. The evaluation indicates that it is viable as the primary examination form in this setting. However, our experiences show that the alignment between learning and examination was not complete since many students took on learning strategies purely focused on passing examination. This was our first evaluation of mandatory participation as examination so of course further research is needed. A multitude of issues need to be explored further, such as facilitating learning processes, technology support for TAs, other ALN based examination forms, and how to further integrate learning and examination.

8. References

Bourne, J. R., McMaster, E., Rieger, J., and Campbell, J.O. (1997). Paradigms for On-Line Learning: A Case Study in the Design and Implementation of an Asynchronous Learning Networks (ALN) Course. Journal of ALN 1 (2): 38-56.

Harasim, L. Hiltz, S. R., Teles, L., and Turoff, M. (1995). Learning Networks: A Field Guide to Teaching and Learning Online. The MIT Press, Cambridge, Massachusetts.

Hiltz, S. R. and Wellman, B. (1997). Asynchronous Learning Networks as a Virtual Classroom. Communications of the ACM 40 (9): 44-49.

Leidner, D. E. and Jarvenpaa, S. L. (1995). The Use of Information Technology to Enhance Management School Education: A Theoretical View. MIS Quarterly 19 (3): 265-291.

Norman, D. A. and Spohrer, J. C. (1996). Learner-Centered Education. Communications of the ACM 39 (4): 24-27.

Nulden, U. (1999). Thematic Modules in an Asynchronous Learning Network: A Scandinavian Perspective on the Design of Introductory Courses. To appear in Group Decision and Negotiation.

Ramsden, P. (1992). Learning to Teach in Higher Education. Routledge, London.

Wegerif, R. (1998). The Social Dimension of Asynchronous Learning Networks. Journal of ALN 2 (1): 34-49.

Fifth Paper

Mandatory Participation in Asynchronous Learning Networks

Urban Nuldén and Christian Hardless

Abstract

In this paper we report from our experiences with an asynchronous learning network (ALN) based course in higher education where participation was not an option but a requirement. Mandatory participation in collaborative learning was the primary examination which had to be passed in order to qualify for the secondary examination, the authoring of a short essay. The evaluations show that mandatory participation as examination (MPE) is a viable format of examination for ALN based learning. The main strength of this format of examination is that it promotes active participation, which is a main ingredient in the desired learning process. Surprisingly, in practice ALN based learning with MPE was not considered beneficial for learning by the students. This is explained by the problematic shift from teacher-centered to learner-centered education and the traditional view of examination as separated from learning.

1. Introduction

In making learning possible, information technology is suggested to be a powerful tool (Pea, 1993). Computers can *"facilitate the development of knowledge building communities"* (Scardamalia and Bereiter, 1994), but it is important to understand the underlying pedagogical assumptions when designing IT for educational purposes (e.g., Leidner and Jarvenpaa, 1995).

The term asynchronous learning network (ALN) is commonly used when referring to information technology based environments supporting teaching and learning (Hiltz and Wellman, 1997). ALNs are used to enhance educational activities and a common use of ALNs

is for distributing course material and information to the students. Various types of conferencing are also provided to facilitate interaction among the participating students.

Examination is important for learning since it is well known that the way students are examined has a strong impact on their choice of strategy for studying. If students perceive that their learning will be measured in terms of reproducing facts or implementing memorized procedures, they will most likely adopt study approaches that prevent deeper understanding (Ramsden, 1992). Even if good results have been achieved in one format of examination, the same students rarely perform as well if they are faced with more challenging formats of examination (Laurillard, 1993). This implies that students can achieve good results in examinations, and still exhibit fundamental misunderstandings. Traditional formats of examination in higher education have long been criticized for being destructive to the process of learning and, as a consequence of this, alternative formats for conducting examination have evolved.

Successful ALN based courses thus need an examination procedure which reflects the intended learning process. Often participation is graded and term papers and other assignments are employed. However, there is very little documented and explicit research about examination in ALN which is surprising considering the importance of examination. Some sporadic results have been reported such as Harasim et.al. (1995) where they suggest to allocate a grade for online participation.

There is a need to find appropriate examination formats which are aligned with the desired learning processes in ALNs. Therefore, in this paper we explore the use of "mandatory participation as examination" (MPE) in ALN based courses. We investigate the perceptions and opinions about this format of examination. The research questions raised in this paper are: Why do students prefer certain formats of examination? And, how do students find MPE in an ALN?

The remainder of this paper is organized in the following sections: First, the theoretical background to this research is given. In the next section, we discuss the motivation for, design of and evaluation of MPE in ALN. In the following section we evaluate MPE from the perspective of the students and investigate some surprising results. Finally, we discuss the results and reach some conclusions.

2. Learning Environments

This section gives a brief theoretical background. The responsibility of the teacher or course designer is to *"make student learning possible"* (Laurillard, 1993) by creating a learning environment which effectively and meaningfully supports learning. In creating such a learning environment our understanding of education and the learning process is influenced by three main pedagogical ideas. These ideas are the grounding assumptions, i.e., *"the fundamental assumptions underlying our conception of the teaching-learning process"* (Duffy and Cunningham 1996, p. 171) and includes:

- the understanding of learning as individual construction of knowledge, i.e., constructivism (e.g., Leidner and Jarvenpaa, 1995),
- the insight that both individual learning and collective learning can be supported by the group, i.e., collaborative learning (e.g., Leidner and Jarvenpaa, 1993) and
- the notion of formative assessment as a complement to summative assessment (e.g., Kvale, 1975; Rowntree, 1977; Ramsden, 1992).

These three ideas are situated in the context of asynchronous learning networks. Constructivism, collaborative learning, formative assessment and ALN are discussed further below.

2.1 Construction of knowledge

The model of choice in education has been, and still is, the objectivist model of learning. In this model, the dominating activity is preformed by active teachers who present information to passive students through lectures and written material, such as textbooks. The objectivist model has been criticized for stimulating surface learning (O'Neil, 1995), knowledge reproduction or knowledge telling (Schank, 1997), instead of knowledge building (Scardamalia and Bereiter, 1993). Knowledge building is based on a constructivist world view where knowledge is constructed as it fits the individual's experience of the world (Harasim, Hiltz et al., 1995). A knowledge building strategy sees the learner as an active participant, interacting with the environment. In this view, learning is *"the active struggling by the learner with issues"* (Duffy and Cunningham 1996, p. 174).

The constructivist model stresses the crucial relationship between new experience and what is already known, since people can only understand what they have constructed themselves

(Leidner and Jarvenpaa, 1995). Learning develops through encounters with new information that is different enough to be stimulating, but not so alien that it cannot be assimilated into the learner's mental structures that constitute her present state of understanding (Watson, 1996). Learning must build on the students' own knowledge, needs and interests, and the learners must be motivated to learn (Schank, 1997).

2.2 Collaborative learning

Collaborative learning consists of activities including, peer interaction, peer evaluation, and peer cooperation, with some structuring and monitoring by the teacher. The basic premise underlying collaborative learning is that learning emerges through shared understanding of multiple learners (Leidner and Jarvenpaa, 1993). The essence of collaborative learning is that active participation is critical to the learning process and that learners have knowledge valuable to other learners. Learning is sharing, and the more that is shared the more is learned. Collaborative learning assume that students are likely to learn as much from each other as from course material or from the teacher or the tutor. Thus, collaborative learning is a creative process of articulating ideas, *"having them criticized or expanded, and getting the chance to reshape them or abandon them, all in the light of peer-discussion"* (Rowntree 1995, p. 207).

2.3 Assessment of learning and examination

Different types of assessment of learning and examination are used throughout the education system, and there are many competing, and sometimes conflicting, understandings of the meaning and purpose of assessment and examination (e.g., Kvale, 1975; Rowntree, 1977; Ramsden, 1992). Control, however, seems to be the dominating aspect in the concept of examination and used to determine if the students have learned, or rather remembered, what they are expected to. Understanding and analytical abilities are not really asked for in most traditional examinations. If so, the instructor would have problems in assessing the student. Both students and educators are more comfortable if answers can be considered as objectively right or wrong. In terms of the control perspective, the outcome or the product of educational activities is referred to as summative assessment.

Another perspective, formative assessment shows that assessment can help students to learn and educators to learn about how best to teach them. Students are a diverse population, they vary in knowledge, skills, interests, and learning styles, and require extra support to engage in unfamiliar tasks. Formative assessment uses scaffolding to provide support and accommodate diversity. Scaffolding refers to the support provided so that learners can engage in activities

that would otherwise be beyond their abilities (e.g., Jackson, Stratford et al., 1996; Jackson, Krajcik et al., 1998).

Formative assessment and summative assessment have been discussed in terms of assistance and assessment. Assistance promotes learning, growth and development. Rather than measuring the minimum competencies, assistance starts with where the learner is, and then designs plans for promoting acquisition and development of new skills. In contrast, assessment implies quality control as a means for deciding whether the learner has acquired the minimum level of knowledge.

Grading and categorizing should however not necessarily be viewed as a "bad thing" (Ramsden, 1992). Exams are stimulating to many students, and they are also efforts that are tangible. It is clear that educators face a dilemma, since they are responsible for both helping students to learn, and for grading them. Educators may encourage critical thinking when they are teaching, but often examine students according to conformity in ideas and detailed knowledge about facts. In those cases, the examination format is unaligned with the learning philosophy and will constitute a gap between strategies for learning and for assessing learning.

2.4 Asynchronous Learning Networks

The term asynchronous learning network (ALN) is commonly used when referring to information technology based environments supporting teaching and learning. ALNs are built using various tools for computer mediated communication (CMC). Examples are email, bulletin boards and newsgroups, synchronous chat systems, computer conference systems, group decision support systems, and most recently, the World Wide Web (WWW) (Hiltz and Wellman, 1997). In an ALN, learners form a community where they are engaged in collaborative learning at the time and place of the individual learner's convenience (Bourne, McMaster et. al., 1997). By slowing down interaction, learners are given time for reflection, and for preparing ideas, questions, comments, to be shared with other learners.

3. MPE in ALN

In this section we discuss the motivation for, design of, and implementation/evaluation of MPE in ALN.

3.1 Motivation

There needs to be a balance between the pedagogical intentions, examination formats and learning environment characteristics. We believe there is a good "fit" between collaborative learning, MPE and ALN since they all focus on active participation in collaborative activities.

Collaborative learning stresses active participation in the learning process. For dialog among learners to be fruitful, learners must be engaged and share understandings, not just passively read others' contributions. Most research on ALN based collaborative learning emphasizes this (e.g., Harasim et. al, 1995; Hiltz & Wellman, 1997; Bourne et. al., 1997).

For meaningful learning to occur, examination must be congruent with the learning philosophy. Otherwise the examination procedure will promote unwanted learning strategies rather than wanted. MPE is an examination format that promotes active participation in online discussions among learners. Mandatory participation in ALN based collaborative learning offers integration between examination and learning, and supports the belief that it is not possible to separate examination from learning. ALN based courses without mandatory participation will commonly encounter problems, for instance Almeda (1998) *"found limited group interactions taking place in the absence of requiring such interaction as parts of the students' course grades."*

Courses using ALNs are well suited for active participation in learning activities. A discussion of participation versus presence highlights some strengths of ALNs over traditional classrooms. To be present is simply to passively attend group sessions, and to participate is to actively contribute to group sessions. Attendance does not imply active participation and this is where traditional classrooms are weak. In a traditional classroom learners can attend and seemingly participate. In an ALN, those who just attend are considered as lurkers and they are invisible.

Participation in educational activities is more than an issue of learning and control, it is also an issue of equality. Learners who try to participate actively can be restricted by a number of social factors (Wegerif, 1998). While, in traditional classrooms, learners must be allowed into the discussion before speaking, in an ALN, learners are part of the discussion at all times and there may be no mechanism for turn-taking. Compare this to 'real-time' discussions, where time is limited and many learners have difficulties in formulating and articulating contributions to a discussion under time pressure. In ALN based discussions, ideas can grow

over a longer period considering that contributions are situated in a multi-topic discourse. Thereby, the moment where the contribution is suitable is extended over time. In traditional classrooms discussions change direction rapidly and the 'right' moments to contribute to the discussion are momentary.

3.2 Design

The idea of MPE guided the design of an ALN based course. MPE is a continuous format of examination where students must be reasonably active throughout the course. Learning activities should be evenly spread out over the duration of the course. This way students can choose to be more active during some periods and less active in others. Examination outcome is determined by the total participation, not, as in most traditional educational settings, by large assignments at the end of the course. In order to achieve this flexibility in participation the course can be structured as thematic modules (TM).

TM is a structuring philosophy which divides the course into several self-contained, uniformly structured units (Nuldén, 1999). This is different from traditional modular structuring where a large topic area is divided into subtopics small enough to digest for learners and is presented in a sequence. In TM, each module introduces a separate issue or problem, like tiny islands in a vast ocean of knowledge. The individual construction of knowledge and of 'bridges' between the islands is accomplished through facilitated collaborative activities. Collaboration takes place in smaller groups and facilitation is provided, i.e., formative assessment. Every module has a well-defined beginning and ending. Because each module is self-contained, students can be more or less active in different modules as long as the total participation is 'satisfactory.'

In an ALN used for MPE each group of students has a separate area, i.e. group folder. Within the group folder there is one folder for each module. During a module, the group or teacher creates appropriate discussions in the current module folder. Discussions are areas for individual messages and new messages are appended in sequence to previously posted messages. MPE was applied and evaluated in a course as described in the next section.

3.3 Implementation

Mandatory participation as examination was evaluated in an informatics course for business administration undergraduates. The main portion of the course was based on the design discussed in the previous section, that is, MPE and TM. MPE was the primary examination

which had to be passed in order to qualify for the secondary examination, the authoring of a short essay.

Each module was initialized with a two-hour lecture. The rest of the week-long module consisted of ALN based discussion in groups. An end-of-module summary by each group provided closure of the module. The course lasted 10 weeks, covered 10 modules, and was worth two credit points. The eighty-five students were divided into five groups, each having a teaching assistant (TA) to facilitate online discussions (i.e., formative assessment). Before the course started, the course coordinator and the TAs participated in a half-day workshop to discuss the role of the TA. One of the TAs' many important responsibilities was to inform the course coordinator about students who were not participating and consequently, not fulfilling examination requirements. The course coordinator then judged the student's effort and took full responsibility for any final decision to pass or fail the student (i.e., summative assessment). Determining a students participation was in some cases difficult. Some limited tools to visualize the activities in the ALN were available to make it easier to understand each individual's level of participation but these tools were very much in their infancy. The issue of technology support for visualizing and facilitating discussion is however beyond the scope of this paper but is an important area for future research (Hardless & Nuldén, 1999).

4. Teacher centered evaluation

From the perspective of the course coordinator and the teaching assistants, mandatory participation as the primary examination criterion turned out well. This claim is supported by the course coordinator's and TAs' combined experiences. However, we encountered some problems and below we summarize our experiences from MPE in the course:

- New and different. The contrast of learner-centered education as opposed to teacher-centered caused difficulties for students and teachers who were clearly not used to this learning philosophy.

- Off-topic discussions. Besides discussions of topics not related to the course a more disturbing problem was that students sometimes posted messages to enhance the perceived participation.

- Mature and evolve. At first many students had difficulty seeing the point in collaborative learning but over time some students revised their attitude and realized that one can learn from interaction with other learners.

- Teaching assistant frustration. Deciding when a student was not reasonably active was difficult, especially considering the lack of social context and cues available in the ALN.

5. Learner centered evaluation

In the previous section, we concluded that the course was successful from the perspective of the course coordinator and the teaching assistants. However, we identified a number of weak areas. Therefore, we investigate MPE from the perspective of the students. In this section, we discuss the evaluation of the learners' perceptions of examination in general, and of MPE in particular. We applied the findings from a previously conducted survey (survey 1) to design the survey used to evaluate students' perception of MPE (survey 2). The second survey had some surprising results that led us to follow up with interviews in search for explanations.

5.1 Examination in general (survey 1)

In this section we recapitulate the findings from a previously conducted survey. To investigate students' perceptions of assessment of learning and examination in general we surveyed 371 students in a business school at a Swedish University. There were 192 women and 179 men, between 19 and 49 years old, and with a mean age of 24 years (sd 4.5). The students were anonymous and answered a series of questions about their perception of examination. Both Likert-scale based questions and open-ended questions were used. Statistical analysis was conducted and is reported elsewhere (Nuldén, 2000).

Students were asked what format of examination they preferred: written exam, group assignment, home assignment, longer essay, seminar, short paper or verbal exam. They were to choose only one of these seven well-established examination formats. The result showed diverse preferences for examination format with no obvious "winner." They were then asked to describe why they answered they did. The students' motivations for preferring one type of examination were coded and categorized through interpretative content analysis (Patton, 1990). Each student's answer could only belong to one category. Three categories were distinct in the motivation given by the 371 students: learning, fairness and convenience. Below we look into each category more in detail.

The first category was learning. Almost fifty percent of the students gave learning as a motivation. That is, the preferred format of examination was perceived as a learning activity, or an opportunity to learn. For written exams, examples includes *"I have time to prepare and acquire knowledge in the way I learn best,"* and for short essays, *"it is independent, realistic and it is knowledge that really stays."* For group assignments, an example was *"it is stimulating, and the learning process is really efficient as the problems are discussed in the group."*

As a second category, fairness and equal treatment was given as motivation by one fourth of the students. For written exams, one student stated *"it has to be difficult, otherwise everybody will pass, and with very little effort."* For short papers and longer essays fairness was described in this way *"it shows what the individual student really knows in a realistic and fair way."* Fairness and equal treatment were not stated as motivation by any of the students who preferred examination formats involving groups.

The third motivation category, according one fourth of the students, was convenience. Note that this does not mean convenient in the "getting a good grade easy" way. Rather, a student preferring the written exam stated that, *"written exams, as they are over in a few hours, and I can easily fit that into the rest of my life."* A student who preferred group assignments wrote, *"I find the informal discussions and problem solving to be very efficient and practical."* Some students prefer home assignments, since *"I can work in my own pace, and where ever I want."*

5.2 MPE in particular (survey 2)

To evaluate how the students perceived MPE in the course described previously a survey was conducted one week after the course was completed. Out of the 85 students participating in the course, those who completed the survey were a total of 61 students, 31 men and 30 women, between 20 and 38 years old, and with a mean age of 23 years (sd 4.9). The survey was designed according to the findings in Survey 1 as discussed above, i.e., the three categories. Figure 1 below shows the distribution of the answers to the questions, (1) is MPE an opportunity to learn, (2) is MPE a fair way to conduct an examination and (3) is MPE convenient. The answers were distributed in a six point Likert scale ranging from 1 (absolutely not) to 6 (absolutely).

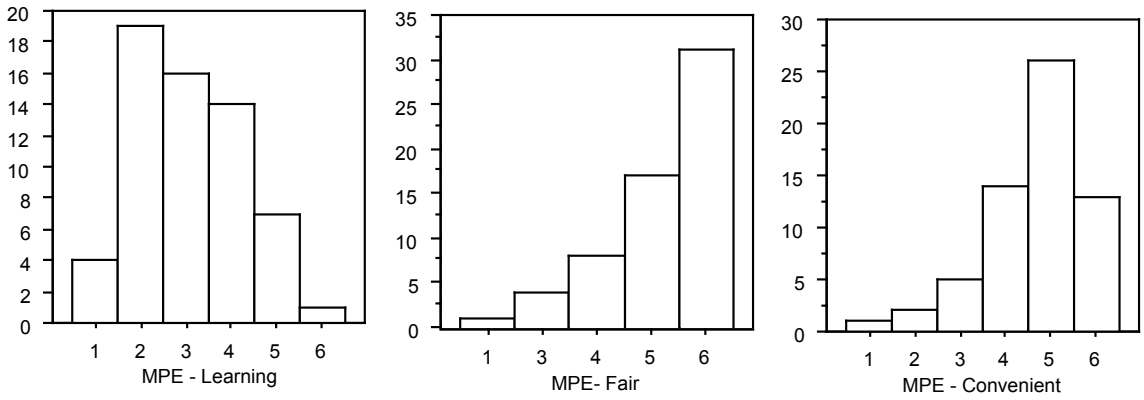

Figure 1: Students perception of mandatory participation as examination

MPE was considered viable in two categories, fair and convenient. The third, and perhaps most important, category 'learning' received significantly lower results. To further investigate this, interviews were conducted with students who had participated in the course.

5.3 Interviews

That the students did not perceive interaction and dialogue with each other as learning puzzled us. Therefore, we interviewed four of the students, one woman and three men. The interviews lasted for approximately one hour each and employed the format of an informal discussion. In the interviews we used Figure 1 above as a starting point and engaged the interviewees in a constructive dialogue.

Regarding reading other participants' comments, several aspects surfaced. *"I did not read that much of what the others had written since everybody wrote the same thing every time."* Quite the opposite was *"I read it all, but only because I wanted to write something nobody else had written."* The length of the comments was a problem, *"some of the comments were more like essays, like one page, is that a discussion? I only read the short ones, and they were only agreeing on something in the long ones."*

One participant was open about it, *"nobody, not even once did anybody respond to my comments in the discussion. I started to write some odd things to provoke the rest of the group, but nothing happened. It made me lose a lot of motivation. But most of all it made me sad."* The lack of professional experience, or work experience in general was also one explanation to the low rated learning. *"I don't see how people without any experience of the profession can contribute anything to my learning? They just think and believe things."*

Authority was an issue, *"I listen to authorities, like teachers, why should I listen to people who know even less than I do?"* The control of meeting the examination criteria was also influencing the behavior of at least one of the interviewees: *"I made sure to say something new every time, in case you were monitoring us. I mean, I didn't want to just agree on what others had said, this cannot be good for the grade."*

The importance of the introduction lecture in the module was mentioned by all. *"It is very difficult to start a discussion, or rather it is impossible, if the lecturer gives the answer to the question. Or as it was in one module he asked a 'yes or no' question."* The order of the modules matters since *"In this type of approach it is very important to have good start. I mean not necessarily the topic, but try to put a hot topic and the most colorful lecturer first. The wrong person first may ruin it all."* However, students agreed that the non-sequential structure of the thematic modules did not affect the discussion in a negative way. The role of the TA was discussed in the interviews. All four were certain that the "learning factor" is very dependent on the TA who must be well prepared.

Instructions and expectations for all participants must be made clear at the start of a course. The lecturer giving the lecture and starting the module must receive clear instructions about the purpose of the lecture. More importantly, the lecturer needs help and support in designing the end of the lecture, i.e., the starting point for the ALN based discussion. *"Meeting a class for only one time, it must be very difficult to raise the right question no matter what area the lecturer is talking about."*

One respondent was unfamiliar with the novel format of the technology, asynchronous learning networks, and the structure, thematic modules. *"I have only lived in Sweden for a few years. This was the first time ever that I did something like this in an educational setting."* The other three respondents made very similar comments. One of them said, *"to me, learning is when I read a book, or when a teacher tells me what's important."* Some experienced frustration in articulating opinions: *"the first module I sat and stared at the computer for more than an hour, I had nothing to say"* and *"It is difficult to write well. When you say things it's not as important."* The intangible nature of a discussion was also raised: *"Maybe I learned something in the discussions, but what? If I read a book I know I learn something."*

The interviews can be summarized in the following three points: First, introducing new students to a course applying MPE must receive extensive attention. Second, in the same way,

the person introducing each module must be thoroughly supported by the course coordinator. Third, the students admitted that working (learning) with TM/ALN and MPE was new to most students, but that as they became more familiar with the approach they saw the potential in it.

6. Discussion

MPE was evaluated from two perspectives: First from a course coordinator and a teaching assistant perspective, and second from a student perspective. In this section we discuss the findings.

The transformation from a teacher-centered to a learner-centered view of education was more difficult than expected. We assumed that resistance to and frustration with the new course structure would gradually decrease and that students would appreciate ALN based learning and MPE. This assumption was partly true since the students successively became more accustomed to their new roles and responsibilities. While students found MPE both fair and convenient, they did not find it very beneficial for learning. There exist several possible explanations for this:

MPE is a sufficiently dramatic change that students need time to acclimate. In many ways, this was a total twist to most students in how to think about learning. Some students may still feel inclined to say: *"OK, so we've had our discussion: now tell us what you want us to learn for the exam"* (Rowntree, 1995, p. 214). Clearly, these students expect examination to be separated from the learning activity.

Our own experience showed that the roles of the teachers, course coordinators and teaching assistants are different in ALN environments and require new perspectives, skills and competencies.

7. Conclusions

We have evaluated MPE in ALN and conclude that the approach has potential if certain problems are resolved. One issue is that students do not regard ALN based collaborative learning with MPE to be valuable from a learning standpoint. This means that MPE, which in theory should be a meaningful format of examination, to some extent in practice is viewed as a non-integrated part of the learning process. Further research is necessary to determine how to deal with measures of participation. However, we would like to emphasize that this is not a

matter of controlling the students and validating accuracy of the information posted, but establishing a climate of true and high quality peer interaction. In this respect, we conclude that promised learning outcomes do not deliver by default, despite good intentions.

8. References

Almeda, M. B. (1998). University of California Extension Online: From Concept to Reality. Journal of Asynchronous Learning Networks 2(2): 1-20.

Bourne, J. R., E. McMaster, J. Rieger and J. O. Campbell (1997). Paradigms for On-Line Learning: A Case Study in the Design and Implementation of an Asynchronous Learning Networks (ALN) Course. Journal of Asynchronous Learning Networks 1(2): 38-56.

Dillenbourg, P., M. Baker, A. Blaye and C. O'Malley (1996). The evolution of research on collaborative learning. Learning in Humans and Machines. Towards an interdiciplinary learning science. P. Spada and H. Reimann: 189-211.

Duffy, T. M. and D. J. Cunningham (1996). Constructivism: Implications for the design and delivery of instruction. Handbook of research for educational communications and technology. D. H. Johansson. New York, Macmillan Library Reference.

Harasim, L., R. Hiltz, L. Teles and M. Turoff (1995). Learning Networks - A Field Guide to Teaching and Learning Online. Cambridge, The MIT Press.

Hardless, C. and Nuldén, U. (1999) Visualizing Learning Activities to Support Tutors. In Extended Abstracts of the Conference on Human Factors in Computing Systems (CHI '99), pp. 312-313, Pittsburgh, ACM Press, 1999.

Hiltz, S. R. and B. Wellman (1997). Asynchronous Learning Networks as a Virtual Classroom. Communications of the ACM 40(9): 44-49.

Jackson, S. L., J. Krajcik and E. Soloway (1998). The Design of Guided Learner-Adaptable Scaffolding in Interactive Learning Environments. CHI 98, Los Angeles, ACM Press.

Jackson, S. L., S. J. Stratford, J. Krajcik and E. Soloway (1996). A Learner-Centered Tool for Students Building Models. Communications of the ACM 39(4): 48-49.

Kvale, S. (1975). Examinations: From Ritual Through Bureaucracy to Technology. Social Praxis 3(3-4): 187-206.

Laurillard, D. (1993). Rethinking University Teaching - A framework for the effective use of educational technology, Routledge.

Leidner, D. E. and S. L. Jarvenpaa (1993). The Information Age Confronts Education: Case Studies on Electronic Classrooms. Information Systems Research 4(1): 24-54.

Leidner, D. E. and S. L. Jarvenpaa (1995). The Use of Information Technology to Enhance Management School Education: A Theoretical View. MIS Quartely 19(3): 265-291.

Nulden, U. (1999). Thematic Modules in an Asynchronous Learning Network: A Scandinavian Perspective on the Design of Introductory Courses. To appear in Group Decision and Negotiation.

Nuldén, U. (2000). Computer support for formative assessment. Information Technology and Management 1 (2000): 329-350.

O'Neil, M. (1995). Towards a Model of the Learner in Higher Education: Some Implications for Teachers. Research, Teaching and Learning in Higher Education. B. Smith and S. Brown. London, Kogan Page Limited: 117-124.

Patton, M. Q. (1990). Qualitative evaluation and research methods, SAGE Publications, Inc.

Pea, R. D. (1993). The Collaborative Visualization Project. Communications of the ACM 36(5): 60-63.

Ramsden, P. (1992). Learning to Teach in Higher Education. London, Routledge.

Rowntree, D. (1977). Assessing students. London, Harper & Row.

Rowntree, D. (1995). Teaching and learning online: a correspondence education for the 21st century? British Journal of Educational Technology 26(3): 205-215.

Scardamalia, M. and Bereiter, C. (1993). Technologies for Knowledge-building Discourse. Communications of the ACM 36(5): 37-41.

Scardamalia, M. and Bereiter, C. (1994). Computer support for knowledge-building communities. Journal of the Learning Sciences 3(3).

Schank, R. (1997). Virtual Learning: A Revolutionary Approach to Building a Highly Skilled Workforce. New York, McGraw-Hill.

Watson, J. (1996). Reflection Through Interaction: The Classroom Experience of Pupils with Learning Difficulties. London, The Falmer Press.

Wegerif, R. (1998). The Social Dimension of Asynchronous Learning Networks. Journal of Asynchronous Learning Networks 2(3): 34-49.