

Activity Visualization and Formative Assessment in Virtual Learning Environments

Urban Nulden and Christian Hardless

Goteborg University, Sweden

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.

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.

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.

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 un-precise and random.

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.

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.

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.