

Using AulaNet for Web-based Course Development

Abstract: A variety of technologies is being used to replace or supplement the face-to-face learning process, including the World Wide Web. In this paper we present AulaNet, an environment for creating, updating and attending Web-based courses. Here we illustrate some dynamics of three experiments of course development and delivery with AulaNet, pointing out their features. We discuss how easy and how difficult it is to orchestrate technology for educational purposes.

Keywords: Web-based Education, groupware, learningware, course development, course analysis

Paper Type: technical paper

Introduction

Advances in education technology, coupled with changes in society, are creating new paradigms for education [Khan 1997]. Participants in this new educational paradigm require rich learning environments supported by well-designed resources [Reigeluth and Khan 1994]. The Web can be used to provide opportunities to develop active and customized learning experiences. One of the great values of the Internet, and in particular of the Web, is that it brings the learner face to face with an ever expanding universe of digital information [Eales and Byrd 1997].

Web-based education (WBE) is an innovative approach to delivering instruction using the Web as a medium. A WBE learning environment should include many resources, support cooperation, implement Web-based activities as part of learning framework, and support both novices and experts [Sherry and Wilson 1997]. To do this, a variety of technologies is being used to implement sophisticated WBE environments in order to replace or supplement the face-to-face classroom, including hypertext classes, video and audio conferencing, video streaming, etc.

Empirical evidence demonstrates the value of cooperative learning when compared with individual learning (e.g., Slavin 1989; Tudge and Rogoff 1989), and there has been an explosion of interest in cooperative on-line learning and teaching. However, designing and delivering instruction on the Web requires thoughtful analysis and investigation of how to use the Web's potential in conjunction with instructional principles [Ritchie and Hoffman 1997]. While all this technology helps the teacher to create meaningful instructional materials, it hampers the task of paying attention to the effectiveness of each technology (and combination of technologies) for education.

In this paper, our aim is to present a WBE environment—AulaNet—and to discuss some experiments of courses delivered using this environment. Our method in the present exploratory research was to study the strategies and technologies used to develop these courses and the mechanics of their delivery for a deeper understanding of their effectiveness for both teachers and students.

AulaNet

AulaNet is a Web-based groupware learning environment developed in the Software Engineering Laboratory (LES) of the Department of Computer Science at the Catholic University of Rio de Janeiro (PUC-Rio), for creating and attending distance courses. The objectives of AulaNet are to adopt the Web as an educational environment; to foster a workable transition from conventional classrooms to virtual classrooms, giving the opportunity to reuse existing educational material; and to create knowledge communities [Lucena et. al. 1998].

AulaNet differs from the majority of digital learning environments available because it is based on a groupware approach while most of the other related environments virtualizes the traditional school physical metaphors: corridors, blackboards, general office, classrooms, library, etc. In addition, AulaNet makes a clear distinction between content and navigation.

The main beneficiary of this environment is the teacher. We believe that a teacher should master his subject domain and not necessarily be obliged to know a lot about the Internet. The teacher's task is to create good quality instructional material, leaving the Internet navigation programming to the environment. With AulaNet the teacher does not need to know any kind of Internet programming languages to create, update and give distance courses. AulaNet fosters the separation of content from navigation releasing the teacher from the programming task. Therefore, in principle, there should be no burden migrating content developed for AulaNet to any other similar system.

Based on the availability of tools tested by the LES, the following preliminary check-list was proposed: (a) publication of the text book as hypertext; (b) publication of texts associated to the lectures; (c) recording lectures with the instructor present; (d) online transmission of lectures with the instructor present; (e) publication of students' projects; (f) forms of assessing students (exams, etc.); (g) use of slides plus description of slides; (h) interactivity on the Internet; (i) use of news; (j) form of online support to the organization of the course; (k) students as information providers; (l) use of animation, video etc; (m) use of software by the students; (n) lectures in the laboratory and (o) definition of development of the learning process.

To provide all these features, AulaNet offers a set of communication, coordination and cooperation mechanisms, so that the teacher can customize his course according to the intended goals of the learning process.

The communication mechanisms provide the features which allow information to be shared or sent to teachers and learners. These mechanisms include e-mail tools (simple e-mail tool and a discussion list tool), an asynchronous text based conferencing tool (newsgroup facility) and a synchronous text based conferencing tool (chat).

The coordination mechanisms provide the means to make sure that the class participants (team) work effectively and meet their goals. The environment offers basic scheduling tools (calendar management) such as an agenda to set up events like chats and announcing deadlines and course news to serve as a billboard about developments on the course. These mechanisms also offer competency based coordination tools (assessment), such as tasks and a tool to create and correct on-line exams, named Quest [Choren, Blois and Fuks 1998].

The cooperation mechanisms provide the means for joint cooperation in learning, solving problems and undertaking tasks, that is, the means to share ideas and information. In AulaNet, cooperation should be understood as the preparation of material by the teacher for the learners' consumption and also, in a constructivist way, making room available, for other people (invited teachers and learners) to prepare material that could be incorporated into the course later on. Among these mechanisms there are tools for material upload and teacher and learner co-authoring assignment.

AulaNet also has quite a comprehensive administrative interface. Its features include management of: participant registration in the environment; teacher privilege assignment; course publication; course blocking; student enrollment in courses; environment interface customization.

Currently, AulaNet version 1.9 is available both in Portuguese <ead.les.inf.puc-rio.br/aulanet> and English <english.les.inf.puc-rio.br/aulanet>. It has over 1800 registered participants (\approx 3% of those with teaching privileges) and it is being used to offer almost 40 Web courses.

Methodology

This study used a sample of 3 courses developed during the second semester of 1998. These courses were chosen because they used different approaches to deploy the course. There were no constraints about the course subject, and the teachers created them from the beginning, that is, they created the structure of the course program and input their own material into it.

There is no uniformity deliberately because we did not intend to make a comparison, just finding out the possibilities of course structuring and delivery using the technology available within the environment. This way, we could check if they fit for diversified learning purposes. Also, in two of these courses, the participants (teacher and learners) were experimenting with on-line courses for the first time.

Course 01: "Let's put it on the Web approach"

The Financial Calculus course is given for undergraduate students of the Administration Institute of PUC-Rio. Its syllabus covers basic administrative subjects, like interest rates, financial plans, inflation, etc. Since this is a regular course, it already had certified paper based materials, such as text books, student notebooks, exams from previous terms, references, etc. In the second semester of 1998, the teacher gave the course using AulaNet.

All this previously existing material allowed the teacher to set up the Web course completely before making it available. Although the environment has administrative features to manage participant registration and student enrollment, the Administration faculty carried out a pre-enrollment process. This can be explained by the fact that this course is part of the Administration Course curriculum. Thus, only the pre-enrolled students, who would get a certificate of conclusion, asked for registration in the environment and enrollment in the course. This is important because the students were a closed group throughout the course term and this decreases heterogeneity. It was a very small group (\approx 20 participants) who could be in a classroom.

The teacher used the simplest approach to offer the course. He chose the cooperation mechanisms that allowed the existing materials to be re-used, then he turned that materials into digital media and put it in the course. As a communication mechanism, he chose contact with instructor (e-mail tool) and as a coordination mechanism he chose course news. It is important to mention that the teacher did not use mechanisms of group communication, of Web-based assessment or mechanisms that allowed student contributions. The teacher simply decided to offer the traditional course using the Web.

The students' learning process was basically a self-directed, just-in-time learning process. There was a high level of individualization, so that each student learnt exactly what he/she wanted at the time he/she needed. This can be explained partly because the teacher did not select any mechanism of cooperative communication. The course did not make the learning a social process, just individual. The students went to the course site, took a look at the available material and directed their questions to the teacher using e-mail. All the learning assessment was done in the traditional paper based way. The teacher played the role of a monitor, answering the students questions, correcting the exam papers and giving grades.

Comparing the effort cost of developing this course with developing the face-to-face course given before, they are very alike, not to say the same. No additional demand was required from the faculty or the teacher, except for the fact that it was necessary to digitize the previous material. Besides, the course did not use any expensive technology, such as audio and video. The teacher provided almost the same feedback for the students that he would have provided in a classroom.

It is also important to say that neither the teacher nor the students had had any previously experience with Web courses, so the results achieved by this experiment were considered rather satisfactory for its purpose: to substitute the classroom for the Web in a conservative course. The environment did help the teacher to offer the course and the students gave a reasonable performance. Though this study did not compare the students' performance in relation to the previous face-to-face versions of the course, no student had greater difficulties in taking it.

Course 02: "Computer Mediated Communication approach"

The Evaluation of the Quality of the Web Information course was given for an audience composed of teachers of all learning levels sponsored by a commercial consulting enterprise. Its syllabus covered a single topic: to evaluate the quality of the educational information available on the Internet. This course has never been given before and the enterprise did not have any previous material for it.

Registration and enrollment in the course were done directly using the environment administrative functions. However, the teacher chose to give a pre-course discussion with participants who were interested in attending it. This discussion resulted in a group of students who enrolled in the course at the beginning and who did not receive any certificate. The teacher did this to avoid overcrowding, creating a medium-sized group (≈ 40 participants).

Since there was no previous certified material for the course and the purpose of the course was to debate the quality of information, the teacher chose a group discussion approach (computer-mediated-communication, CMC). Therefore, he chose all the communication

mechanisms available, all the scheduling mechanisms to coordinate the discussion and the mechanism to allow student contribution. The idea was to let the discussion take place, and at the end the students, divided into small groups, would create some material of their own. This material would be used for informal assessment of these students and also as certified material for future versions of this course.

CMC itself requires a form of organized interaction between people. Besides, all the participants had made an agreement before the course was set. The learning process was cooperative with intense student participation during the course. There was much interaction, mainly asynchronous using the discussion list. The teacher played the role of an animator, trying not to simply lead the discussion, but inviting all students to participate.

However, all this participation created a communication overload. To decrease the effects of the overload, the teacher had to detect the topics of more interest and divide the students into smaller groups who were in charge of creating some material about one specific topic. After that was done, the communication was basically inter-group and between the groups and the teacher. Intra-group communication was almost not observed.

Comparing the costs of this course with a face-to-face one using the same approach, they would seem to be very alike. The teacher did not have to prepare any previous material, but the cost of providing feedback to the students was much greater. In a face-to-face classroom, the teacher would have the power to pause the discussion, make comments and avoid the communication overload. This control does not exist in a distance discussion. Therefore, providing constant feedback to the students became an expensive task. It required the teacher to be a kind of synchronous participant, even though most of the discussion was asynchronous.

Course 03: "Cooperative Learning approach"

The Information Technology Applied to Education course is given for graduate students of the Computer Science Department of PUC-Rio. It was offered by teachers of the AulaNet Team. Its syllabus was about Web-based education itself, covering topics like WBE concepts, groupware, learningware, interactive multimedia, WBE course design, etc. In fact, in the second semester of 1998, this course was in its second version, and had some digital certified material from its first version.

This was planned to be the test drive course for AulaNet. The teachers wanted to see if the environment would be fit to host Web courses. At first, this course had a very restrictive audience, thus, the teachers agreed to let any interested participant attend it. Yet, only those who had previously enrolled in the course at the Computer Science Department would receive a certificate. Everybody had to register and enroll in the course using the administrative functions of the environment. The teachers allowed students to enroll in the middle of the course: if someone entered the course in the middle, it was up to the him/her to follow the rest of the group. Since it had no acceptance restrictions, there was an enormous group of students (over 200).

As this course was planned to test the environment's capabilities, the teachers chose all its communication, coordination and cooperation mechanisms except for the exam assessment strategy and the workspace for student contribution. The course had some certified material

which was put in before it was offered, including: texts (for lectures), slides, video recorded with the teachers, papers (which were turned into digital in html format), and messages from previous discussions.

The course had a very specific logistic: (1) contents of the course was divided into major topics; (2) each week the students had to take a look at the material of one topic; (3) they debated this topic using the discussion group; (4) at the end of the week, one of the teachers mediated a chat about the chosen topic. After the discussion had taken place, some tasks were assigned to the students in the format of works (assessment) and the five most "interesting" topics generated newsgroups, for more detailed discussion. It is important to say that this logistic did not prevent students from communicating with each other, taking a look at the materials of other topics or discussing other subjects than the topic of the week.

There was great student participation, creating a social group learning process, with the teachers facilitating the social interaction. Nonetheless, the size of the group allowed the creation of observers, students who did not actively participate, who just followed the discussion passively. This can be partly credited to inhibition or to some sort of disinterest (all the students who were actually enrolled in the course at the Department did participate, but the others participated at random). Another problem faced was the realization of the chats. Many students could not be in the environment at the right time and the actual number of participants was always very small (≈ 10 participants).

Comparing the cost of this course with a face-to-face course, it was very expensive and time consuming. It was necessary to record video presentations, to prepare new material, to answer student questions, to animate the asynchronous discussions at a reasonable time, to animate the chats, and so on. The teachers also had to provide constant feedback for the students. This demanded a backstage group to help the teachers (the AulaNet Team) and some infrastructure, such as cameras, video encoder software, multimedia authoring tools, special recording room, and so on.

Some Analysis

The experiments showed three different kinds of courses. We can say that the AulaNet environment offers features to support the three of them. AulaNet allows the use of digitized conventional material, hypertext, communication tools, coordination mechanisms, etc. It provides a variety of technology to deliver Web-based education programs.

Though the environment seems to fit its purposes, it should provide more help for the teacher to pay more attention to understanding how the students learn with technology. We saw that the students' actions vary, not only from course to course but also in one same course. Learning environments do not provide the facilities to enable the teacher to determine if the overall learning objectives are met when using technology. In fact, research has to be done to find out what are those facilities.

Firstly, we can see the interaction aspect. Course 1 demonstrated a very low degree of interaction between participants and the other two courses showed a high degree of interaction. It might seem that the first course was not really a course designed for a cooperative learning environment. However, an important assumption of Piaget's (1980, 1985) theory was that the source of conceptual development is alternation between

equilibration and disequilibrium of cognitive structures. New knowledge is not directly constructed on the social plane, but rather by solving internalized cognitive conflicts [Hakkarainen et al. 1998]. Cognitive conflicts interrupt the process of interaction repeatedly, continuing the process in the mental plane.

On the other hand, according to Vygotsky's (1962, 1978) sociocultural theory, interaction between less and more able members of a community fosters conceptual growth through internalization of cultural-historically formed conceptual tools. Interaction between peers enables each participant to achieve new competencies or skills within his or her zone of proximal development [Hakkarainen et al. 1998]. Thus, we do not consider that course 1 lacked interaction, but the students acted according to their previous culture. We see that it is important for a WBE environment to allow for different learning cultures and cognitive frameworks to co-exist.

Another important point is the size of the group. It is difficult to manage many people at a distance. Learning environments provide the communication but lack its content management, which falls entirely on the teacher's shoulders, causing communication overload. Besides, the traditional learning process is very individual, with communication taking place only between the teacher and the student. Cooperative learning at a distance needs to be better understood. Students can learn in teams, but it demands much more from the group to use technology properly. Courses 2 and 3 pointed out the difficulties faced by groups to set a cooperative course. The cooperation aspect goes beyond traditional education, being very important even for corporate work. Professional corporations look forward to having their workers trained in teams.

We also saw that more sophisticated Web-based courses impose demands on infra-structure and on faculty staff, which we called throughout the text as cost of course development. Preparing material and taking care of discussions are consuming tasks. And both the material and the discussions must be attractive to provide student engagement. More and more, entertainment and learning are mixing together. A course should have multimedia material, such as videos, which are not easy nor cheap to make. The teacher will need support, in infra-structure and in people, to create interesting material to catch the students' attention (audience).

An additional point is the teacher's role. About the traditional education system, Carrol (1968) affirmed that "By far the largest amount of teaching activity in educational settings involves telling things to students" (p. 4). But a Web course requires more from the teacher. It has become commonplace today in education circles to talk about changing the teacher's role from a traditional didactic one to that of a facilitator [Reeves 1994]. This shift augments the task that the teacher has to do, such as, animate discussions, give feedback to the students, etc. Putting course content online is more than a matter of converting the syllabus to HTML and placing it on a server [Koyanagi 1998].

These factors—group size and teacher facilitator role—have a direct impact over the participants' performance. The facilitator is important to encourage participation, steer the focus of the interaction, resolve conflicts and if necessary (as shown in courses 2 and 3) act to ensure that the goals of the learning process are reached. Loose interaction disturbs the course environment, makes the participants feel overloaded and lost, thus lowering their learning

performance. We could see, for example, that course 1 had the smallest group and had less "focus losing" problems.

Assessment is another incipient field on web-based learning. Two courses shown above decided to use an informal assessment strategy, while one still used a paper based strategy. It would be desirable for the learning environments to dissolve assessment during the learning process. For instance, AulaNet provides an exam facility [Choren, Blois and Fuks 1998], but no one wished to use it. Exams lead to the well defined picture of student confinement. Reliability is a key word to spreading the use of distance assessment.

Conclusion

In this paper we have briefly described AulaNet, a learningware environment for creating, updating and attending Web-based courses. AulaNet is designed to help communication, coordination and cooperation within the learning process. We have presented three experiments of courses developed and delivered with AulaNet, pointing out their features and difficulties. We have tried to show how technology relieves and hinders the learning process.

Our goal with this study was to point out the cost of web-based courses, the extra demands it imposes, the feedback the students will require, etc. Ideally, all these features should be considered before creating a distance course, but it is not always possible. This study does not take into account other factors such as time implications - how much more or less longer a learner construct knowledge using the environment - or satisfaction implications. There is no "good model" of distance learning, or "the best way" of orchestrating technology to the learning process yet. We still need to learn how to learn with technology.

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