Methods for Distance Learning using the Internet

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1 - Introduction

Efforts have been directed to adapt traditional teaching techniques to modern times. Times when the use of technology, such as computing and Internet, are becoming society's daily habits.

However, the simple adaptation of traditional teaching methods to new technologies do not meet the expectations of the current generation of students. They lived, since early age, using modern technology and may suffer when educators do not take advantage of the new facilities provided by technology. There is a gap between current teaching practices and what can be achieved using new tools and techniques.

For this reason, efforts should be directed to develop technology that empower the teachers, enhancing their ability to teach. We think that this technology should allow interaction between teacher/student and student/student to take place naturally, easily and produc-

tively. The interaction leads to cooperation, and cooperation to better learning.
Currently there is a variety of educational techniques that makes use of computer resources and the Internet, but they are not usually focused in cooperation.

2 – Main Goal

The main objective of this work is, using tools developed by our research group, to develop, implant and manage a distance education course over the Internet. This course is targeted to students that already have a degree (in computing or engineering). Data about the course and its active community of students is to be collected.

The work is based in bibliographic research from various sources, research in specialized Internet sites and experiments, which include some done by other institutions. The course offered over the Internet is called "Distributed Programming Using Java" and can be found at the address `http://java.icmc.sc.usp.br/java_course`.

3 - Distance Learning

There is not a final and precise definition of distance learning, but, in spite of certain conceptual divergences, there is a set of features that characterizes it:

- Arétio [ARE96] defines distance learning as being a bi-directional (and massive) technological system, used in a strategy of teaching, that substitutes the interaction teacher - student in the classroom for the systematic support of didactic resources and tutorial material to propitiate to the student an opportunity for autonomous learning.
- Moore [MOO96] defines it as a planed learning that usually occurs outside of the traditional teaching places and, as a result, requires a course project, special instructional techniques, special methods of electronic or other communication technology, as well as, special organizational and administrative systems.
- Roberts [ROB96] considers that in practical terms, the distance education is projected to assist students that, for geographical or temporal reasons, are unable to attend live courses. The principles of access equality have been important values that lead this field.

Relatively to the history of distance learning, it can be traced from the appearance of the post-office to the arrival of the fiber optics and satellites. One can classify the evolution of distance learning reaching from the apostle's S. Paulo epistles in the Gospel to the arrival of the Internet.

Sá [4] classifies the distance learning evolution into three generations. The first was the 'textual', it used only printed text and includes whatever happened until the 1960 decade. The second was the 'analogical', it happened between the 1960 and 1980 decades. The third and current generation is the 'digital', it is based almost exclusively in technological resources that provide characteristics such as: low cost and efficient communications, high interactivity and the high numbers of available interconnected computers.

3.1 - Some positive aspects of distance learning

- It has the potential to make viable basic and professional learning for several socials segments;
- It facilitates and extends the access to knowledge in a fast and cheap way;
- It may attend to a great number of students in a single time, with a cost potentially reduced;

- It allows the permanence of the student in his own professional, cultural and family environments;
- It brings flexibility to questions like: 'where' to study (place), 'when' to study (time), and 'at which velocity' to study (speed);
- It eases the learning process by extending the channels of communication and interaction, turning the teaching/learning process more flexible and individualized;

3.2 - Some negative aspects of distance learning

- It may restrict socialization, due to the reduction of opportunities for interaction (other than virtual) among students and teachers;
- It increases the risk of homogeneity in the instructional material: all learning the same, just one educational package, with few opportunity of student – teacher dialogue;
- The ambition to attend the maximum number of students may provoke numerous abandon, desertion or failure; this can be due to a lack of good accompaniment of the learning process;
- There are high initial costs for implementation of distance learning courses;
- The administrative services are, generally, more complex than live courses;

4 – Self Learning

It is considered important that the participants of distance education programs should possess characteristics of autonomous students [LIN96]. The ideal students have to take the responsibility of their own learning:

- They should be able to select the activities that will lead them to their objectives.
- They should accompany their own learning and be able to diagnose weakness.
- They should be able to seek help when they work in topics they do not understand
- They should allocate their study time for the most important aspects of the course.

The autonomous students should establish realistic goals and readjusting its progress accordingly. They generally receive the grades they expect, because they understand the relationship between their actions and their performance [LIN96].

When the teaching methods are more flexible, the learning styles can also be. When a distance education program happens over the Internet, the student should be stimulated to adapt to the wide use of the resources that offered by the net. In this way, a variety of learning styles can be implemented.

The modality of distance learning courses can sometimes suggests the irresponsible believe that it is possible to study less. However, this modality of study does not eliminate the responsibility of the students, on the contrary, the individual student is even more responsible for his success or failure. The emphasis in this project on cooperation is a way of stimulating people to commit themselves as a group to the effort needed to finish the course. Group commitments are in general stronger then individual ones.

Still in relation to the care that should be observed in the development of programs for distance learning, it is observed that some actions should be taken in order to obtain success [LIN96]:

- The courses should have goals that the students can realistically reach.
- The students should have the opportunity to engage in a process of autonomous learning.
- The courses should establish collaborative communities able to tackle complex problems, similar to the ones the students will confront along their careers.

5 - Computers in the educational process

The growing of use of technology in the educational process have facilitate the sharing and multiplication of knowledge. New technologies have performed an important part as distribution channels of educational information. More and more institutions discover the advantages of distance training for their employees, not only due to the reduced cost but, mainly, for the possibility of involving group of individuals at the same time and in dispersed regions.

The computer technology provides new interactive ways for overcoming time and distance. Harasim [19] says that the education in the 21 century should prepare the students to integration in a globalized economy, based in knowledge, in which knowledge will be the more critical resource to the social and economic development.

There are several ways of using computers in the educational processes:

- [BAR92] Computer Aided Learning (CAL) and Computer Based Training (CBT).
- [AED00] Computer Assisted Instruction, (CAI).
- Computer Managed Instruction (CMI).
- Computer Mediated Communication (CMC).

The resources used may involve: tutorials, educational games, simulations, multimedia CD-ROM, electronic mail, conferences, electronic bulletin, Internet, WWW, listservers, newsservers, chat, etc. However, the utilization of these tools does not occur without some disruption with more traditional teaching methods.

Many new tools are being developed here at ICMC-USP to deal with computers in education: EHDM (Educational Hiperdocuments Design Method) [PAN98], StudyConf [MAC99], HyDTS [MOR95] HyperBuilder, QuestBuilder e TaskBuilder [SAN98], SASHE (Sistema de Autoria e Suporte Hipermídia para Ensino) [NUN97]. As well by other institutions like the WebCT [WCT00] and AulaNet [AUL00].

Other institutions are running distance education courses: Master's Program at a Distance for IBM, Universidad Nacional Experimental Simon Rodriguez (UNESR), Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM), Open Learning Austrália (OLA), Electronic University Network (EUN), The Open University (United Kingdom).

6 – The Courses at the ICMC - USP

The Internet growth has opened an extensive field of possible resources to be used for distant training. These resources can be used to attain levels of interaction between teachers and students and among students themselves comparable to the ones obtained in a schoolroom. Students will benefit from educational projects that are based on transparent, flexible, open, and reliable standards.

We propose training programs based on:

- Educational content.
- Tools for interaction.
- A methodology for teaching distance courses.

Just making available computers and educational software to teachers and students is a start point but it is not enough. Teachers should be prepared to take advantage of this new technology through the introduction of new teaching techniques.

Our research group works exploring this new techniques through the developmentof several on-line

courses: Distributed Programming using Java, Object Oriented Programming, Operating Systems (graduate course), Operating Systems II, Microprocessors and Microcomputers, and Introduction of Electricity for Computing.

These courses can be accessed over the Internet through the address http://java.icmc.sc.usp.br. They can be used not only by the students from USP (University of São Paulo) but also by outsiders.

The system has many available services to students such as: information about calendars, programs, and management tools such as: news groups and FTP (File Transfer Protocol).

The teacher produces the course's materials and, by using developed tools, does the management of the students tools and services, such as: updating the calendars, assignments to be handed in within dead lines, etc. These routines are being improved to make the system easier to use to teachers from fields not related to computing.

Through a statistical control of Web access, it was noticed a high level of accesses to these courses from outside USP and it was concluded that there is a growing demand for distance learning courses. There is also a necessity from many external users of certification from USP or others institutions.

7 – Management of Distance Education Courses over the Internet

Using the management tools [SIL00] presented here the teacher is guided through the process of creating a management area, where information about a specific course can be stored in a database, and physical disk space for the storage of homeworks. The figures 1, 2 and 3 present some illustrations about the process of a course creation. The tool for the course creation allows the selection of the activities to be performed by the students.

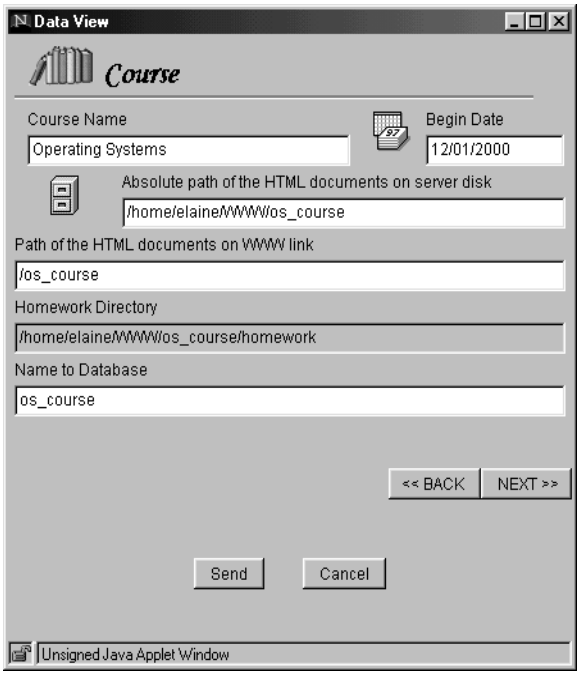

Fig. 1. Definition of basic information about the course

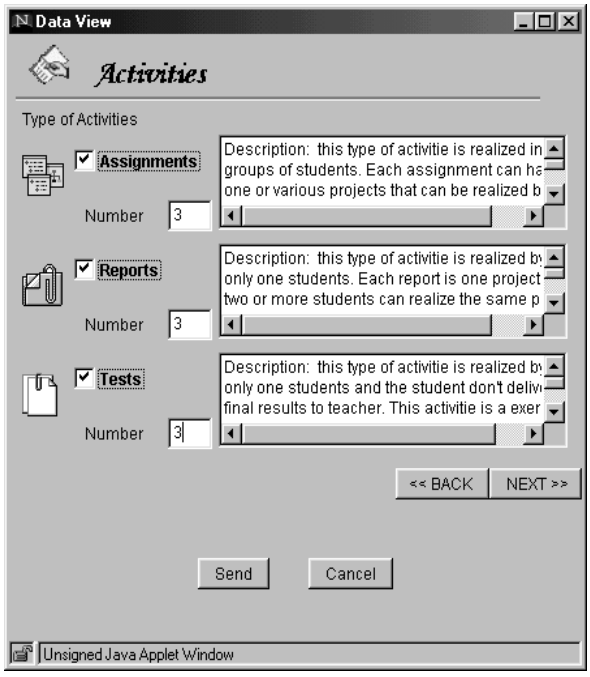

Fig. 2. Definition of types and number of course activities

The teaching methodology supported by these management tools favors the exchange of information and the cooperative work among the students of a course. In the creation of the teaching environment, the teacher has the possibility to choose which types of activities he wants to develop in his course. He can opt for assignments, reports, and tests:

- Assignments are types of activities that “induce” cooperative work. They allow the assignment of work to groups of students and the writing of reviews for these works by other groups. These activities should generate as a result reports “posted” in the site of the course.
- Reports are activities done individually that should also generate a report “ posted “ in the site.
- Tests involve individual activities defined by the teacher, for example, tests or exercises, that do not generate a “posting” to the site of the course.

The tools are not linked to the teaching material. When the teacher creates the environment of the course, he reserves a space in the course WWW server and in a database for each specific course. In this way, the information concerning the assignments, reports and tests of a course must be explained in hyperdocuments written by the teacher.

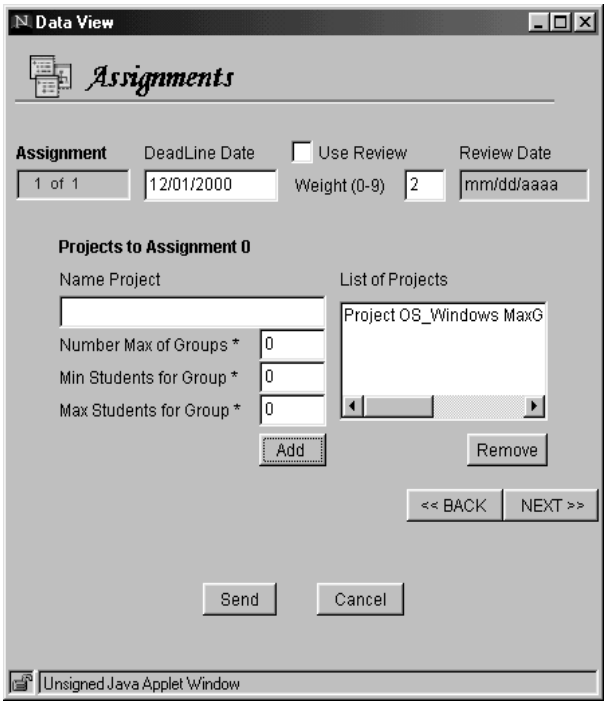

Fig. 3. Definition of properties for one activity assignment

Fig. 4. Form to the student register as candidate for the course

After a course becomes available over the Internet, the students have to register. Registered students are able to join the course and use the available tools for interaction. There are tools for transfering files, formation of working groups, alteration of passwords, viewing of grades, calendars and others. The figures 4, 5, 6 and 7 present some tools interfaces for students interaction.

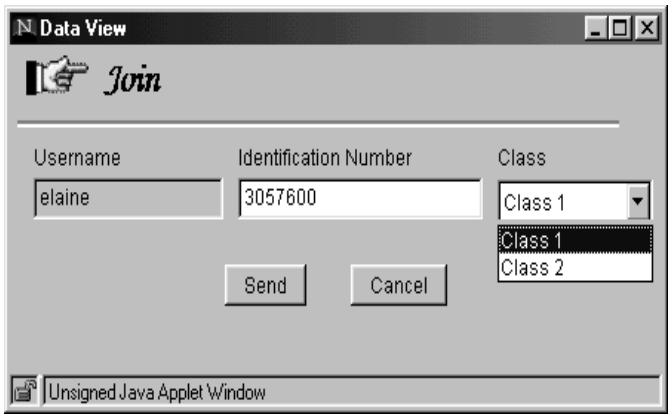

Fig. 5. Interface for the students join the course

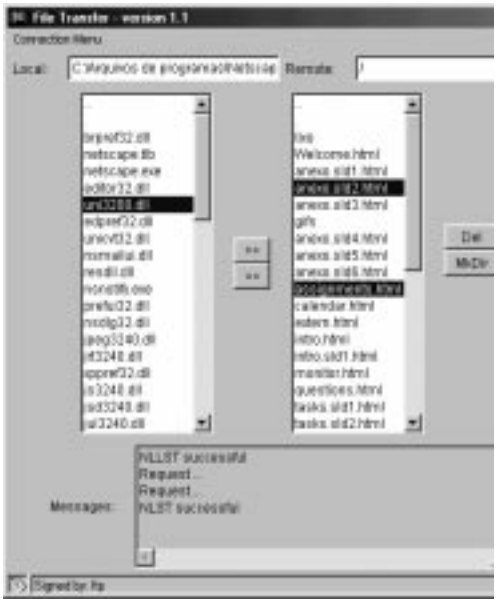

Fig. 6. Interface for transferring file to the course area

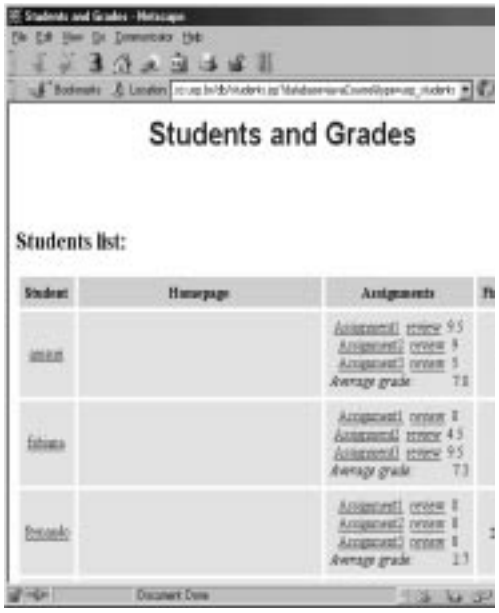

Fig. 7. Interface to the student visualize his grades

6 – Conclusion

In general every school follows a determined teaching methodology. Teachers also bring in their background and teaching philosophy.

It was presented the use of management tools developed in Java as a resource to be added to the teaching material of on line courses. These tools can improve the student interaction with the course material and promote cooperative work among students and educators. This tools can support a teaching methodology that has as its main objective the motivation of groups of students to cooperatively participate in distance education courses. The tools have characteristics that allow them to be applied in several types of teaching activities over the Internet.

The tools have been used in classroom courses assisted by activities and material in the Web (with access freely open to anyone in the net). Now we are going to use them in a distant education course. This project is testing and evaluating the distance learning tools and methodologies which are used today at

the Institute of Mathematics and Computing (ICMC-USP), in an attempt to create new technologies to satisfy the needs of outside students in continued education programs. These methodologies should motivate cooperative work developing in the students the capacities and skills to do it.

It is necessary that the university (and other schools) be prepared to use the new technologies that are necessary to motivate students for formal and informal collaborative work. The university should adapt itself to the current necessities of its students as well to their future ones, as professionals, through continued education programs. This can only be achieved efficiently using the Internet.

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