Elearning mathematical projects in university

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Abstract
Since the academic year 2005 - 2006 a few elearning projects are active at the University Milano-Bicocca, and at the Catholic University of Milano, both Faculty of Economics, with CILEA as the technological partner. They involve a large number of students attending basic courses of Mathematics.
The common platform is Moodle (URL: http://moodle.org), contents are in HTML, PDF, Flash format using LO in SCORM 1.2 format.

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TEOREMA
TEOREMA, an on-line Mathematics preparatory course, serves on average, during a whole academic year, about 2000 students. Its contents, entirely on line, cover the minimal mathematical requirements needed to take, and successfully pass, Calculus and more advanced quantitative courses.

TEOREMA is an innovative tool not only for its technological aspects but also because it is the first Italian project of university teaching jointly developed by the major universities in Lombardia, a northern Italian region (University of Bergamo, Bocconi University, University of Brescia, Carlo Cattaneo University, LIUC, Insubria University, Catholic University of Milano, State University of Milano-Bicocca, University of Pavia) and CILEA (Consorzio Interuniversitario Lombardo per l’Elaborazione Automatica). Currently, TEOREMA is in use mostly by the last three universities.

The contents of the traditional mathematics preparatory course have been standardised among all the teachers, courses, universities involved and also with the help of the Italian “SYLLABUS DI MATEMATICA”, a Mathematical public accessible guideline for university students-to-be, made in 1999 by UMI (Unione Matematica Italiana). This document has been developed with the aim to help Secondary School students willing to enroll at scientific faculties, to correctly understand all the issues and efforts involved and required by their studies. All this peculiarities have contributed to render the same preparatory course a well-gauged tool to be applied to many economic Faculties.

In the first phase of the project, lasted about three years, TEOREMA has been developed on a Lotus Learning Space platform (by IBM) for the LMS framework, the course structure and the tracking system (all deployed on a Windows SQL Server 7.0 data base). In its second, and more recent phase (started with academic year 2005-2006), after a deepened revision of the contents (in HTML, PDF, Flash format using LO in SCORM 1.2 standard format), TEOREMA has migrated on Moodle (URL: http://moodle.org).

In those years many new solutions has come out on the field of elearning, especially in the Open Source world. This new approach, not only talking about the economical impact, has allowed much more control, quality and personalization on the solution proposed to final users. A better control has been realized by teams of developer publicly working on the

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code, by final users comments, requests and revisions, by the real possibility to inspect, analyze and modify the code by anyone interested. Better quality and personalisation has been achieved by final users doing the debugging phase, but in an active and aware, way in a kind of virtuous spiral converging to real, operative, and not simply commercial, needs.

Our TEOREMA project has got some real benefit by these new trends in elearning, in particular from the standing out of Moodle, an Open Source LMS (Learning Management System) product (or better, as Martin Dougiamas, father and Lead Developer of Moodle, says “an LMS project”).

We preserved all didactical materials from the previous LMS platform, reworked and re-engineered them, made a whole revision and correction for typos and mistakes and deployed and brand new version on this new platform, during the spring and summer of 2005.

This course, and all the courses from it derived, are running on Moodle on a Linux server, only partly dedicated to this service, at CILEA site in Segrate (near Milan). The operating environment includes a Linux Operating System (a Debian “Sarge” distribution), an Apache Web Server with PHP language support, and a MySQL database system.

We delivered this new running environment at the beginning of the 2005-2006 academic year, on 5th September, with the beginning of Mathematics first year pre-courses at State University of Milano Bicocca.

At present, TEOREMA is available in two different modes:

- **Standard mode**: students can access, asynchronously, course contents, and can perform self-evaluation test, having an immediate feedback of their performance. To support the online course, some frontal tutorial lessons have been given so as to discuss with the teachers and tutors topics and exercises to be clarified.

- **Plus mode**: beside the standard mode a synchronous and asynchronous service is offered: students and teachers can get in contact in different ways: through the forum, FAQ, chat and e-mail.

The Standard course has been given to 2.464 students, with 7.299 accesses and 112.125 logs, whereas 245 students have participated to the Plus course with 3.416 accesses and 49.605 logs.

CILEA, besides cooperation with teachers in developing technical solution and deploying didactical material, offers an help-desk service to students using our online courses. It’s a first aid service, supplied with a semi-professional online trouble ticket systems: students compile a web form with some request or comment, which generate a “trouble ticket” which is taken in charge by someone of the technical staff. All questions, comments, answers and solution are logged and recorded; in this way we have been able to measure and improve our responses’ time and our quality of service to the final user.

In order to evaluate the effectiveness of TEOREMA Plus mode and to track the improvements in mathematics, a sample of students (150 students) has been selected and an evaluation test has been performed at the beginning and at the end of TEOREMA. The result has been quite encouraging: the mean score before and after the “treatment” has increased of 5/33 points.

It is remarkable that the evaluation test, applied to Catholic University and Milano Bicocca students, has given the same results in both universities.

The extension of the on-line preparatory course to the last year Secondary School students could bring even more remarkable results. In this way, the Secondary School students could verify, and if necessary, complete or supplement their mathematical knowledge in the perspective of a future enrollment in an Economic Faculty, thus anticipating the mathematical requirements needed to successfully attend quantitative courses.

**MATECOMARK**

MATECOMARK is a new experiment carried on in the curriculum of Communication and Marketing of Milano Bicocca. It is conceived as a “fast lane” course and follows ideally TEOREMA.

After an evaluation test given to TEOREMA Plus mode students to access to MATECOMARK, 149 students were enrolled. A dedicated web site (MATECOMARK in URL: http://elearning.cilea.it) contains course material, exercises, self-evaluation tests, FAQs and forum activity. The teaching staff includes the professor, four tutors (a small class of 38 students each) and one part time graduate student. The aim is to combine new elearning techniques to “personalized” teaching; instead
of the “classical” 48 hours of frontal teaching in a 4.5 credit course, students stay in class onethird of their time, but they are closely monitored by their tutors. This is particularly useful for first year students, who often find it difficult to adjust to the new university standards and still need close help. Examination includes two evaluation test taken in the computer lab generated within the dedicated web site. The teacher/administrator can track at any time the complete history of each student/record and through summary statistics know how the class progress is related to the historical course performance. MATECOMARK is a “fast lane” mathematics course: students who have difficulties in taking pace can easily follow the same course given “in presence” with traditional classes the second semester. The “replication” in presence will take advantage of the web material and contents, still available after MATECOMARK ended. The following chart describes the project phases.

MatFin online

MatFin on line is a new experiment carried on in the curriculum of Business Administration of Milano Bicocca. The course of Financial Mathematics (a second year course, 4.5 credits) is now given in blended mode: 16 (out of the traditional 48) hour classes, including tutorials. 290 students are currently enrolled, two official teachers, two tutors take care of them. The dedicated online course (like MATECOMARK in URL: http://elearning.cilea.it) is extremely active, with a populated forum.

Many students work and find it very useful not to be forced to be in a traditional class, often not knowing the other students. Simply they do not show up in class. With the forum help, students know each other and understand and share their common problems. On the other hand, if any student feels that he/she needs more frontal classes or finds difficulties with the elearning mode, he/she can take the same course the second semester in traditional mode, given by the same teachers of MatFin online.

Conclusions

The elearning projects we are carrying on in Catholic University and Milano Bicocca and the encouraging results we get, allow us to draw a few considerations:

1. The need of front classes is directly proportional to the difficulty, from the student’s side, to manage himself. This means that first year students need front classes much more than experienced second or third year students. Having this in mind, we can enhance elearning without forgetting the necessity of a face to face contact.

2. A consequence of the first statement is that through elearning we can manage increasingly large classes: from a 1:30 ratio (MATECOMARK) we can easily pass to a 1:70 (MatFin online).

3. Elearning courses are very helpful for student workers, provided that the web site contain all the information and is rich enough to allow a fruitful self study.

4. The success of a elearning course is based on the combination of two important facts, both involving motivation: on the demand side, students must be “brave” enough to chat with their teachers, to share their problems with other students, to accomplish the requested tasks. On the supply side, teachers must be motivated enough to
accept that working in elearning can be more demanding than just entering in class and giving a lesson. First of all teaching material must be precise, scheduling must be respected and clear rules have to be given in advance. The web site must be revised daily by adding material and the forum must be taken care of. It is very sad to enter in a deserted forum: the student feels alone and gets the impression that the teacher does not care (with consequences possibly even worse than in a traditional course).

5. From the teacher point of view, even though the initial investment is high (creating the environment, teaching materials, scheduling, recruiting skilled people, etc.), the learning course pay back can be estimated in three years: after this time the course has reached its maturity in term of content stability, teacher expertise, accurate scheduling and timing.

References


[8] “SYLLABUS DI MATEMATICa,