

DISTANCE TEACHING OF MATHEMATICS FOR STUDENTS OF ARCHITECTURE: IS IT POSSIBLE?

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Abstract

On the basis of our experience as teachers of Mathematics in the School of Architecture of the University of Buenos Aires and with the support of an expert designer of image and sound, we undertook the task of distance teaching the subject Mathematics II for students of Architecture. The academic guidance of Ms Spinadel, PhD, the university's authorization and the support of a computer platform provided by Nueva Internet S.A. have enabled the completion of this project. We were encouraged to set up the distance teaching of the subject by the many advantages the system offers, namely, the chance for students to work at home with a computer-based platform containing all of the subject's contents and to integrate and apply all the knowledge acquired in architectural contexts; and the chance for teachers to offer on-line guidance and tutorials. Distance teaching is not to be understood or configured as an accumulation of calculus procedures. Rather, it should be thought of as having the major aim of promoting the full development of the students' imagination for the solution of architectural design problems. For that purpose, students must become familiar with the interface to be used as the virtual classroom, read the theoretical introduction to every one of the units, solve application problems (the students are provided with all the material, which they can visualize on line or print), and send their tutor all the queries they may have so that the process of teaching and learning is facilitated and enriched. The solution to exercises is presented in a didactic manner and students can resort to additional bibliography, image and formula galleries and a technical help forum provided by the software firm. A virtual classroom has been set up where students and teachers interact all the time. Students must also submit integrative assignments, which are corrected by the tutor and will form part of the subject's final assessment, together with an in-person exam at the end of the semester. Excellent results have been obtained so far, being that this is the first time a subject of the Architecture course is taught this way. This paper is intended to share this experience and show how, in spite of the modality of the subject, the interaction achieved between students and teachers has proved to be very enriching.

Introduction

In order to take the distance course in Mathematics II, students must have basic mathematical and computing knowledge. One of the requirements to attend the subject is that students must have passed the subject Mathematics I, but they must also attend a compulsory in-person class where the virtual classroom is accessed and where teachers can explain how the course will develop, how the students should work in the virtual classroom, what assessment criteria and methods will be used and how to access the on-line technical support.

Why Mathematics II should be a distance course

The main advantage of the distance modality is that all the necessary information about and for the subject is available to all the students. The theoretical contents, the solutions to the exercises, the image and formula galleries, the annexes with detailed contents for further reference, the glossary and the permanent on-line tutorials are all available in the student's personal computer. There's no need to attend university except for the two mid-term tests. Another advantage is that the distance course lasts a

semester while the in-person course lasts a whole year. This avoids the overlapping of exams and contributes to the students' organization of their time and their study schedule. As a result, there is a fall in the drop-out indexes, for it is the students themselves that organize their study time (although a four weekly hours' study time is suggested).

The virtual classroom

To access the virtual classroom students must have a personal computer connected to the Internet. All the material in the classroom can be stored in a disk or printed (pdf option is available).

After attending the in-person class where students are shown through the virtual classroom, they are given a class by class schedule to help them organize their work throughout the semester.

Each unit of work is divided into classes and the exercises are designed to provide practice for the contents learnt in each unit. That's why it is suggested that students start by reading the theory and only then pass on to the exercises. They can contact their tutor if they deem it necessary. The interaction between students and tutors is fundamental for the teaching and learning process and it greatly enriches it. The tutor is continually demanding that the student be present by sending help files, theoretical questions about the class being taught and anything that might favor the understanding and application of the contents. Students are encouraged to consult all of their doubts and not to pass on to the next unit until they have fully analyzed and studied the previous one, for each unit depends on the previous one.

For each unit, an integrative assignment with application exercises must be solved and submitted, and will be considered part of the final grade. Students can consult their tutors as many times as they need, and they can solve the problems with other students, although submission is individual (students are divided into classes of 20 at most and each class is taught by a tutor, who is a Mathematics teacher). The solutions to the exercises in the assignment are uploaded after the submission deadline for the students to self-correct their work. At the same time, the tutor sends each student a correction of his/her assignment, with details on the correct exercises, the incorrect exercises, the mistakes made and the theoretical contents that have been misunderstood or misapplied.

Apart from the theoretical contents, the solution to the exercises and the on-line tutorials, students are offered access to additional material to further their learning process: formula and image galleries, help files sent by the tutor according to the needs or doubts of each course, a glossary, annexes for further reference on each content dealt with and technical support where students can solve any problems they might encounter when going about the virtual classroom, in charge of the firm Nueva Internet S.A., which also controls the e-mails sent by the students to facilitate the teachers' work. Technical support ranges from any technical problem that may arise in the handling of the webpage to the explanation of the procedure to follow when, for example, attaching a file to a mail.

Summing up: all the necessary material, a virtual teacher at home and a help desk for technical conflicts are all available to the student at all times.

Assessment

Assessment is divided into two stages:

First, students submit one assignment per unit of work. The exercises in these assignments are designed to promote the full development of the students' imagination for the solution of architectural design problems.

Second, students must take two in-person tests, organized as follows:

-First mid-term test: shape geometry, symmetry and proportion, probability and statistics

-Second mid-term test: applications of derivatives and integrals, topography

Should the students fail any of these, they can make up at the end of the semester.

If the students have passed the assignments and the two tests, they can sit the final exam, which is theoretical in nature and intends to integrate the knowledge acquired by the students through the course.

Design of the virtual classroom: overview

It is very important to note that transforming the subject Mathematics II into a distance course, with adequate material, was hard work, especially because of the nature of the subject's contents. The effort was made from a very special perspective: the focus was placed on the application of the contents and there is a great variety of examples, which allows students to analyze the theoretical contents and immediately use them in a concrete application. In this sense, Prof. José María Galeano's help was invaluable. Manager of educational development at Nueva Internet S.A., he has plenty of experience in teaching distance courses. And it is also worth mentioning that the characteristics of the platform facilitated the distance teaching-learning process.

The platform contains all types of information, clearly organized and laid out:

- A menu divided into contents (with the theoretical units divided into the weekly classes), tutorials (whatever concerns the exchange between the student and his/her tutor) and participation (directed at having all the students in the class meet, and perhaps chat, following on each student's progress and proposing issues for debate).
- Once inside each unit, students can access the glossary, the bibliography and the annex (with detailed contents for further reference). There's also a summary chart with each lesson's key words.
- Students can read the noticeboard (where the tutor posts his/her messages to all the class with the academic news) and the messages (answers to queries made by the students and which the tutor decides whether they should be shared with the rest of the class)
- Besides, students can consult information about their classmates (My class), their teachers (Teachers) and their grades (Grades).

An additional platform for tutors allows them to access all the information about the class he/she teaches. They can receive and answer the mails sent by the students, keep a strict control of the grades, set up topics for debate about the contents of each unit, send public or private messages to their students, complete the report cards of their classes and among other things, keep track of their students' access to the virtual classroom.

Results

It is important to highlight that the results mentioned below correspond to the first time the subject was taught on a distance basis. Here are some observations about the work itself and the results obtained:

- The course only included an in-person exam and a corresponding make-up, both practical in nature and which enabled the students to sit the final exam.
- Five classes were made up with approximately 18 students per class. They were in charge of: Prof. Jorge Blumenfarb (tenured), Prof. Rosa Ma. Escayola and Assistants Prof. Silvina Bauleo, Prof. Alicia Ferreira and Prof. Emma Sala (all of them are teachers of Mathematics with experience in teaching at university level). Vera M. W. De Spinadel, Ph.D. was in charge of the coordination.
- Some students worked individually and some others, because they were friends or had already met, worked in groups for the integrative assignments. This was also due to the fact that most students do not have access to broad band Internet and therefore did their work on the university's computers, at Internet stores or in their homes, with a dial-up connection.

- One of the problems encountered was working with mathematical operations with the Word equations editor. The students received a tutorial lesson for the set-up and handling of the editor which included several examples. This facilitated the presentation of and solution to the exercises although some students preferred to solve the exercises manually and scan their answer sheets and send them in the jpg format.
- As regards the design of contents, students expressed they had found them very didactic and welcomed the many examples they include. The intervention of the tutors and the continuous follow-up on the students' progress are in themselves proof of the good results: 70% of the students passed the course at the end of the term and are now in a position to sit the final exam.
- In the regular annual course, 50% of the students drop out by the month of June because they prioritize other subjects which they consider more specific to their architectural studies. The distance course allows a better handling of study time and optimizes the students' chances to meet all the requirements.

Conclusions

When the idea for this distance course first came up, we never envisaged its repercussions. The authors of this paper worked hard during a whole semester organizing the material, in an attempt to present it in the most didactic way possible and bearing in mind the fact that a distance course in mathematics entails a high degree of difficulty. At present, enrolment is open again for 2004 and three times as many students as in 2003 have signed up.

The high percentage of successful students further encouraged us to make the necessary changes to keep improving and perfecting the on-line teaching of the subject. For that purpose, we took into account the difficulties we faced and the opinions of our students who, after all, are the ones who use all the material.

In this sense, it is worth mentioning:

- At the beginning of the course, students will attend a short course on how to set up and work with the equations editor. In general, the editor is a tool they are not familiar with and which greatly facilitates their work when it comes to solving the exercises. At that meeting, they will also receive the complete schedule for the subject.
- In that first in-person class, a computer logged onto the virtual classroom will show them how to handle the webpage.
- Instead of a written exam integrating the five units of work, the students will be assessed through two in-person exams, so that the many contents are not crowded into one large exam. The units will be divided into two:
 - o First exam: shape geometry, symmetry and proportion, probability and statistics
 - o Second exam: applications of derivatives and integrals, topography.
- Students will be encouraged to submit their assignments in the Word format, using the equations editor instead of handwritten files (scanned as images, jpg).
- The integrative assignments will contain fewer exercises (from 20 to 10 per unit) so that students are not overloaded with work and can, with the new exercises, integrate their knowledge to architectural applications (we focus on quality rather than quantity).
- After every class, students will receive a questionnaire with two theoretical multiple choice questions. This will enable the tutor to have a more fluent communication with each student and guide him/her more closely through his/her learning process. Besides, students will be thus able to resort to the glossary and the summarizing chart at the end of each unit.
- An Exams option is included in the virtual classroom, where students can access past papers.

- Students can access their Report cards, where the tutor keeps track of each student's work, including his/her grades for the assignments and tests.
- Teacher-student interaction will continue to be as frequent as it used to (on a daily basis), for this has proved to be a great incentive for the students: they can count on their on-line teacher for as long as they need.

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