Web-based course for teaching Human Anatomy. The UPF experience

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SUMMARY

The extraordinary development of new technologies has led to enormous changes in Undergraduate Education. These changes concern several aspects in teacher/student relationships, and imply new approaches to the teaching of theoretical and practical classes and to the preparation of additional materials.

Human Anatomy is an ideal subject with which to use these new teaching tools. The teaching methods for this subject are easily adapted to new technologies, and with the introduction of new imaging and therapeutic techniques the need for knowledge has also changed significantly in recent years.

In the last few years many initiatives that link new needs in anatomic knowledge with the new facilities offered by computer technology have been taken and show promising results. The use of multimedia materials makes the subject much more appealing for new generations of students, who are more familiar with computers than teachers and are accustomed to using research materials and information from non-conventional resources.

Here we describe our experience over the last four years of introducing multimedia materials via Internet to teach Human Anatomy in the Biology degree at the Universitat Pompeu Fabra in Barcelona (Spain).

Key words: Teaching – Human Anatomy – Computer-assisted learning – Undergraduate education

INTRODUCTION

The extraordinary development of new technologies has led to enormous changes in Undergraduate Education. These changes concern several aspects in teacher/student relationships, and imply new approaches to teaching of theoretical and practical classes, and to the preparation of additional materials. (Drake, 1998; Paalman, 2000; Miller et al., 2002).

Many initiatives taken in recent years link new needs in anatomic knowledge with emerging facilities offered by computers (Carmichael et al., 2000; Trelease et al., 2000; Hallgren et al., 2002) and show promising results (Reidenberg, 2002). The use of multimedia materials makes the subject much more appealing for new generations of students, who are habitual computer users and are familiar with searching for research materials and information from non-conventional resources.

The Biology degree given at the *Facultat de Ciències de la Salut i de la Vida* of the *Universitat Pompeu Fabra* since 1998 is specifically orientated to Biomedicine. It offers biologists the opportunity to gain an in-depth knowledge of human biology that will be useful to them in their future professional activities, be these in biomedical research, pharmaceutical laboratories, or clinical analysis. Clearly, a solid grounding in Human Anatomy is crucial for such activities.

With a total of 120 hours (12 credits) Human Anatomy is a compulsory subject in the first two years of the degree and is divided into two subjects both of which place special emphasis on the descriptive aspects of Human Anatomy and also

Submitted: October 28, 2002
Accepted: February 24, 2003

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on basic concepts of Embryology. These two subjects have been designed to teach students:

- The language necessary to locate the parts of the human body.
- Basic anatomical nomenclature, and location of human body structures.
- Human body parts in images.
- Anatomical regions of humans.
- Basics of Human Embryology: parts of the embryo in general, and those that contribute to shaping the distinct organs and body systems, and the processes that lead to their definitive configuration.

Several factors may hinder these goals. The restricted number of teaching hours affects course contents and the way in which they are taught, which has repercussions in conceiving the program. Moreover, Human Anatomy is commonly believed to be based mainly on rote learning, in which there is little use for reasoning. In addition, Biology students tend to give little importance to morphology for their future professions.

To minimize the potential negative effect that the determining factors may have on teaching, and taking into account previous experiences, we designed some materials for the Internet that could be used as teaching support. Through this support material we aimed to:

- Make the subject more appealing.
- Make lessons easier to follow and understand.
- Ensure that the supporting material is always available and up-to-date.
- Improve teacher/student communication.
- Improve long-term academic performances.

Materials

Specific computing materials were designed for each task: teaching materials, preferably used by teachers, and support materials for students.

The material was prepared using conventional PCs equipped with the Windows 95 and Windows 2000 Professional (Microsoft Corp) operating systems. The images used were obtained from several sources: digitalisation of materials on photographic supports, or slides with a Hewlett-Packard Scan Jet 6300C and the corresponding software; images obtained with a digital camera (Sony DSC70), and vectorial drawings made with a digitalizing tablet (Wacom A4). Whenever possible, we used original images from photographs of anatomical preparations made in the Dissection Room of the Anatomy and Embryology Department of the Faculty of Medicine of the University of Barcelona.

Microsoft Power Point 97 and 2000 (Microsoft Corp) were used for designing the introductions to the theoretical lessons; Microsoft Front Page 98 and 2000, and Macromedia Dreamweaver 3.0 were used for the web pages that make up the course; Corel Draw was used for the vectorial drawings; and Adobe Photoshop 4.0 and 5.0 were employed for processing photographic images.

Each lesson plan was written and recorded onto HTML format. Links were added that allowed users to advance or go back to adjoining lessons, return to the index at any time, and open pages with text illustrations.

In the past two academic years, materials have been edited on CD-Roms, which makes them much easier to use, even from stations with no Internet connection.

Course development

All supporting materials were transferred onto the University Intranet (*Campus Global*), and were only accessible to registered students after identification by a user number and an access key. From this Intranet, students could contact their teacher by e-mail, access support materials for all subjects, carry out self-assessment tests, and administrative tasks (such as registration, and so on). The teachers, for their part, could place material on the system and modify it at will, design tests, send exercises with a deadline, and keep in touch with students both individually and as a group.

The course was given in the conventional way through theoretical and practical lessons. Students had previous access to the contents and graphic material for all the lessons as from the first course day, thereby encouraging them not to take notes, and to play an active role in class. With the aim of holding their attention, our classes were supported by animated introductions made with the Power Point program (Microsoft Corp.), and we avoided blackboard drawings and diagrams whenever possible. Some classes were complemented with video clips, which helped to identify structures in the human body.

A similar approach was followed for the practical classes. Students had previous access to the lesson plan, and they were recommended take the plan to the class so as to be able to examine each preparation on their own. At the end of each class, a group of students chosen at random were tested. A minimum of two tests for each student during the course was guaranteed. The tests results had a maximum repercussion of 5% on the final grade. Three kinds of practical classes were given: those that used anatomical models; human and animal anatomical pieces, and those in the Dissection Room of the Anatomy and Embryology Department of the Faculty of Medicine of the University of Barcelona that used prossected specimens.

Table 1.- Evaluation results.

		FIRST COURSE		SECOND COURSE		TOTAL	
		FIRST EXAM.	*SECOND EXAM.*	*FIRST EXAM.*	*SECOND EXAM.*	*FIRST EXAM.*	*SECOND EXAM.*
YEAR 1998-99	*PASS*	45 (69,1)	56(76,1)			45 (69,1)	56 (76,1)
	FAIL	20 (30,8)	9 (13,9)			20 (30,8)	9 (13,9)
YEAR 1999-00	*PASS*	47 (66,1)	61(85,9)	58 (89,2)	61 (93,8)	105 (77,2)	122 (89,7)
	FAIL	24 (33,9)	10 (14,1)	7 (10,8)	4 (6,2)	31 (22,8)	14 (10,3)
YEAR 2000-01	*PASS*	44 (61,1)	59 (81,9)	57 (95)	59 (98,3)	101 (76,5)	118 (89,3)
	FAIL	28 (38,9)	13 (18,1)	3 (5)	1 (0,7)	31 (23,5)	14 (10,7)
YEAR 2001-02	*PASS*	52 (74,3)	59 (84,3)	51 (80,9)	57 (90,5)	103 (77,4)	116 (87,2)
	FAIL	18 (25,7)	11 (15,7)	12 (19,1)	6 (9,5)	30 (22,6)	17 (12,8)

Results were evaluated by means of student questionnaires to measure the degree of satisfaction at the end of each quarter, before examinations. The knowledge acquired was assessed by three tests (95%of grade): a multiple-choice test (60% of final grade); short questions (25% of final grade), and a practical test (10% of final grade).

Statistical comparisons were made with the Statview 5.0 program (SAS Institute Inc.), and using the Paired Data Test or t-Test.

RESULTS

A total of 333 students took part in Anatomy courses during the past four years (three academic years). An average of 75.1% of these students passed the first period exams; a percentage which increased to 89.2 after the two examination periods per year of both subjects. The second course, devoted to Neuroanatomy and Splanchnology, showed improved grades in the first and second examination periods as compared with the first, which was devoted to the Locomotive System and Embryology (Table 1).

The questionnaires afforded very interesting results. An average of 70% (59%-84%) of the students responded. Regarding the rating given to interest in the subject for future professional activities, all years showed significantly lower ratings than the total average obtained in the survey (Fig. 1). In contrast, the ratings for the quality and

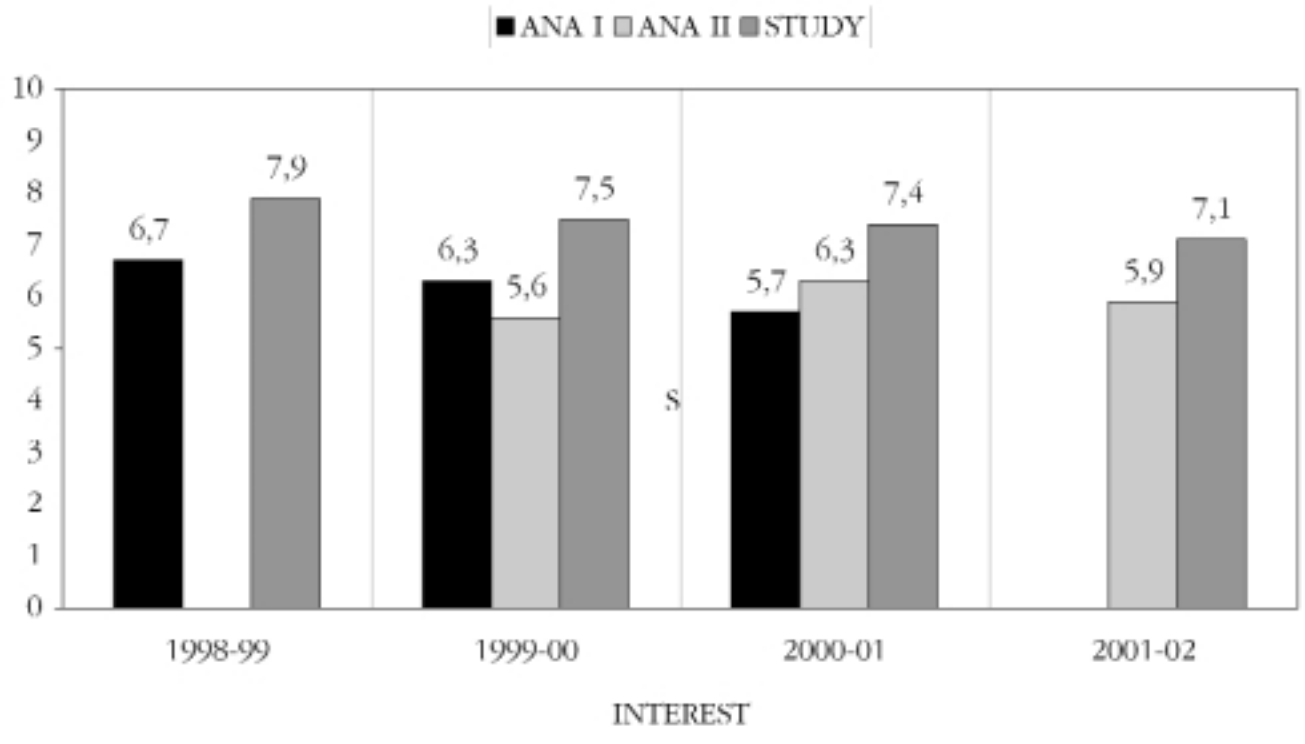

Figure 1.- Results obtained in the satisfaction polls as regards interest in the subject. There are relevant differences when comparing the marking obtained with the average. Year 1998-99 p=0.0003 (first year); year 1999-00 p=0.0006 (first year) and p=0.001 (second year); year 2000-01 p=0.002 (first year and p=0.005 (second year); year 2001-02 p=0.0002 (second year).

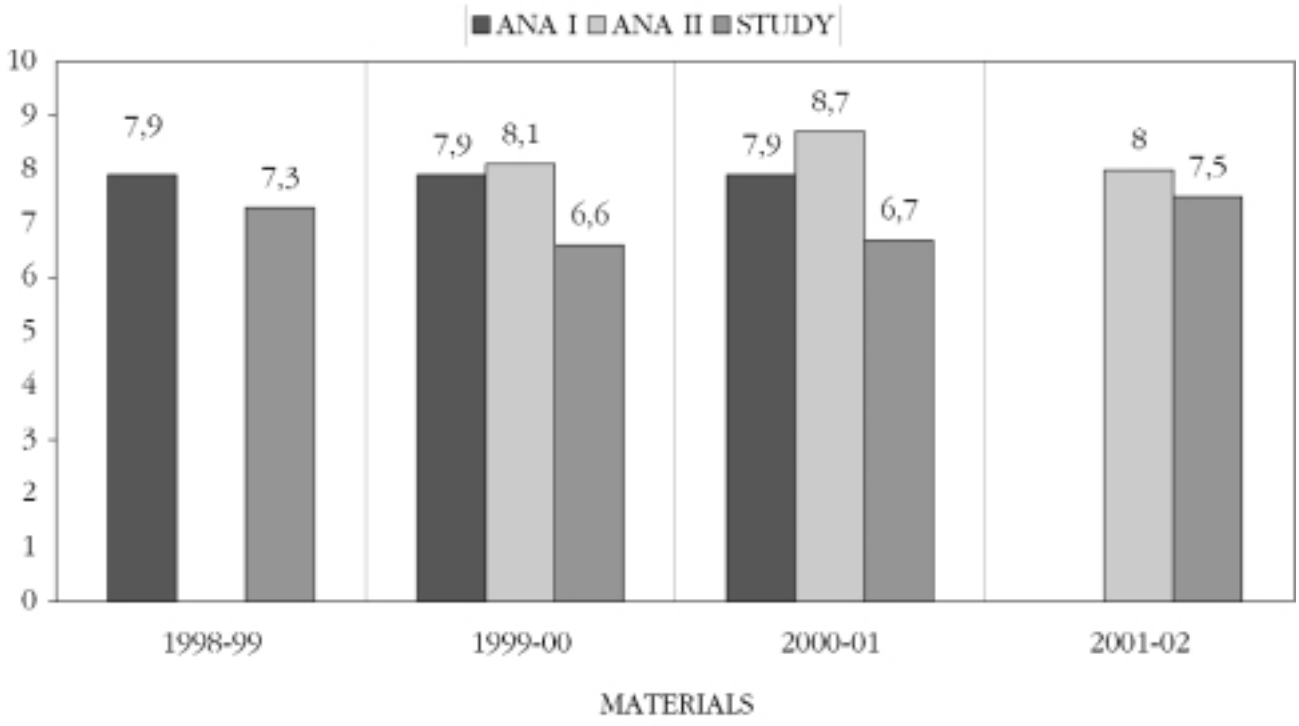

Figure 2.- Results obtained in the satisfaction polls as regards the suitability of the teaching materials. There are clearly significant differences in favour of the materials used for the subject with respect to the average. 1998-99 p=0.001; 1999-00 p=0.001 (first year) and p=0.0001 (second year); 2000-01 p=0.0006 (first year) and p=0.0001 (second year); 2001-02 p=0.04.

suitability of the teaching materials were significantly higher than the average in all cases (Fig. 2).

Discussion

As regards success in passing the subjects, our data show that a high percentage of students easily passed the two subjects in both the first and the second examination periods. The success rate was higher in the second-year subject than in the first. This can be explained, firstly, by the easy adaptation of the students to the subject dynamics in the second year and, secondly, by the contents of the second year, which were in general much more appealing, for students than those of the first year, which were almost exclusively devoted to the Locomotive System and Embryology.

Biology students at our Faculty do not have much interest in Human Anatomy, as shown by the questionnaires (Fig. 1). This could induce a negative effect in performance that is not reflected in results obtained after the examination periods. When students were questioned about the suitability of the teaching materials, their opinion clearly pointed to significant differences with respect to the average obtained by all the remaining subjects (Fig. 2).

On the basis of our results, we conclude that our objectives have been achieved. Although our students showed little interest in Human Anatomy, they reported that the teaching materials offered on the web were useful and helped them to understand and follow the classes. The questionnaire results demonstrated that students were satisfied with the methods of teaching. Moreover, the results showed that student performance was highly satisfactory. In our opinion, improved performance may be attributable to the additional support material provided through this course design.

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