

Production of videos of biochemistry techniques and databases of questions raised

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Abstract

The general objective of this project is the production of materials for use as tools for promoting independent learning in a semi-distance learning environment. Two videos were produced of two basic experimental techniques in Biochemistry: chromatography and radioligand binding. Both videos include the filming of experiments that involved sophisticated manipulations which had to be carried out in the teaching laboratories of the Biochemistry Unit in the Faculty of Medicine. A database of multiple choice questions was produced. This currently consists of 200 classified and reviewed Biochemistry and Molecular Biology questions. Supervised use of the video and the questions, together with assessment of understanding of presence sessions by means of a Rapid Test and linking biochemical knowledge to normal intuitive knowledge, has led to an improvement in the academic performance of the students, as it has increased the number of students passing the subject as well as the proportion of students with good grades.

General area interest of this innovation

In the subject: «Biochemistry and Molecular Biology» of the first year of Medicine and in the subjects: «Biochemistry of the Nervous System» and «Pharmacological Biochemistry» in the current Biochemistry Degree course (3rd and 4th year). Other studies which include Biosciences teaching.

1. Objectives

The overall objective of the project consisted of producing teaching material aimed at improving the student's education and academic performance, for use in a semi-distance learning environment. The specific objectives sought with the materials produced are:

1. to promote understanding of the concepts explained in the theoretical classes.
2. to give the student an idea of experimental techniques that are impossible to cover in teaching laboratories, due to their complexity and/or danger.

2. Description of the project

In order to achieve these objectives, two videos were produced showing experiments that involved sophisticated manipulations, and a database of two hundred Biochemistry and Molecular Biology questions was prepared. Other related initiatives were: *a*) assessment of understanding of presence learning by means of a «Rapid Test» and *b*) linking biochemical knowledge to normal intuitive knowledge in the students' surroundings, using «metaphorical» examples called «Figurative Biochemistry».

Video 1 with the following title:

Teaching video for understanding chromatography: use of the HPLC Technique to determine changes in the synthesis of a neuro: histamine.

This Video has received the following ISBN number: 978-84-690-7137-3

At present, first year Medicine students carry out practical laboratory sessions in which they apply thin layer chromatography to separate molecules and perform qualitative analysis of its presence in samples of tissue. Despite the theoretical principles being basically the same, it is impossible in practice to carry out high resolution chromatography (HPLC), which is commonly used to quantify various molecules, not only in basic research but also in the clinical laboratory. Third and fourth year students in the Biochemistry degree course are aware of the theoretical foundations of HPLC but also cannot carry out high resolution chromatography in practical laboratory sessions due to its high level of complexity and the expense involved.

Video 2 with the following title:

Teaching video for understanding the concept of chemical balance by means of a laboratory practical session : a study of the coliergic muscarinic receptors using the radioligand binding technique

This Video has received the following ISBN number: 978-84-690-7136-6

At present, the theoretical basis of enzymology and the study of first messenger receptors, which share the concept of chemical balance, are explained to both first year students of Medicine and third and fourth year students on the Biochem-

istry Degree course. Despite being crucial in understanding most biochemical phenomena, this concept is difficult to pass on the students properly in both basic and advanced courses.

For the last five years, Biochemistry degree course students have been carrying out laboratory sessions focusing on the study of first messenger receptors by means of the radioligand binding technique, but the level of complexity, danger and expense of this technique, means that it cannot be fully carried out in experimental laboratories.

3. Methodology

Experiments of the same type as those used in the research lines of some teachers in the team, and which use the techniques to be shown, took place during the filming of the video. In this case, the experiments focused on a specific breakdown of the various stages in each technique. Brain tissue from two Sprague-Dawley rats bred in the UAB animal supply facility were used as biological material. The animals were handled in accordance with the European Community Directive on the regulation and use of laboratory animals (86/609/CEE of 24 November 1986) and the Autonomous Regional Government of Catalonia decree (Official Bulletin of the Autonomous Regional Government of Catalonia 2450 7/8/1977). The experimental procedures were approved by the Animal and Human Experimentation Ethics Committee of the UAB and used in previous studies (Torrent et al., 2005; Robles and Sabriá, 2006).

Video 1, focusing on chromatography, presents:

1. Obtaining samples suitable for the study of neurotransmission from brain tissue
2. The basic foundations of two types of chromatographies: ion exchange and HPLC
3. The application of these techniques to a practical example the study of changes in the synthesis of the histamine neurotransmitter due to the effects of depolarizing stimulants.

Video 2, which focuses on understanding the concept of balance, presents the introductory part which is not possible to undertake in the practical laboratory, in the following sections:

1. Obtaining cerebral cortex membrane samples
2. The basic foundations of the radioligand binding technique
3. The application of these techniques to a practical example determination of the dissociation constant of a high affinity muscarinic ligand by means of a saturation curve
4. The mathematical working which is the basis for calculation of the dissociation balance constant (K_d) of the ligand to its receptor

The video is designed to be shown just before the students begin the experiment. After the experiment is completed, the data obtained by the students in the laboratory are analysed in the computer room in order to obtain the K_d value.

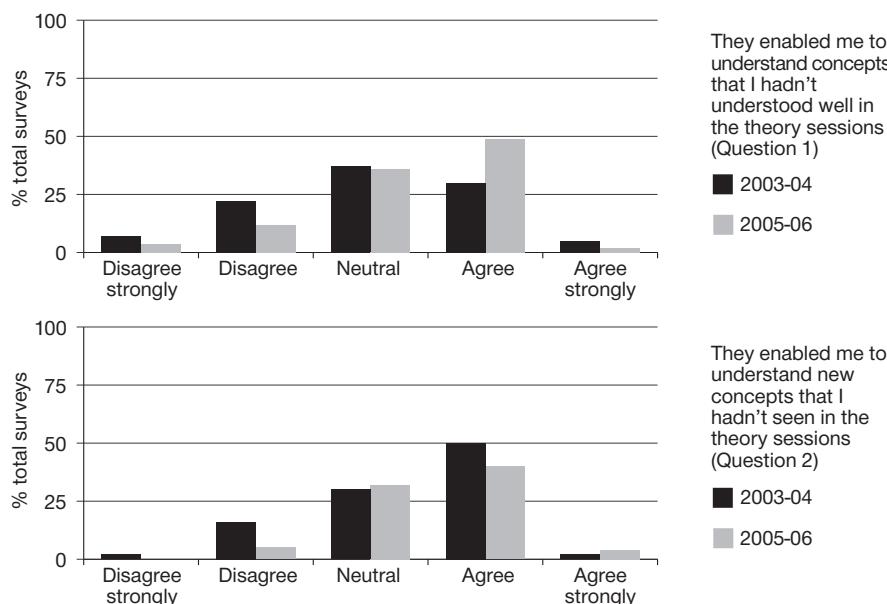
In order to make up the database, multiple choice questions were used, as well as short answer questions used in course examinations and/or classroom seminars over the previous 4 years.

4. Results

4.1. Use of the videos

The results of the use of the previous educational videos for the 1st, 2nd and 3rd cycles is currently in the assessment phase. Despite the assessment process being in its initial phase, there are observations available from previous courses, in which videos on techniques for obtaining biological samples and experimental techniques with cell cultures have been used with 1st year students on the Medicine degree course and 3rd year Biochemistry degree course students. In both cases, comparison of the grades obtained by the students in the sections covering the subjects dealt with in the videos showed an improvement in grades (an increase of 0.25 points in the final grade), and the improvement was also noted in students' performance and motivation based on a survey evaluating the practical sessions, and their protocols which were published by the UAB in 2005 (Sabriá et al. 2005) (Figure 1).

Figure 1. Results of the surveys on the perception of practical sessions of 1st year Biochemistry and Molecular Biology students in Medicine (2003-2004 academic year: 166 surveys; 2005-2006: 236 surveys)



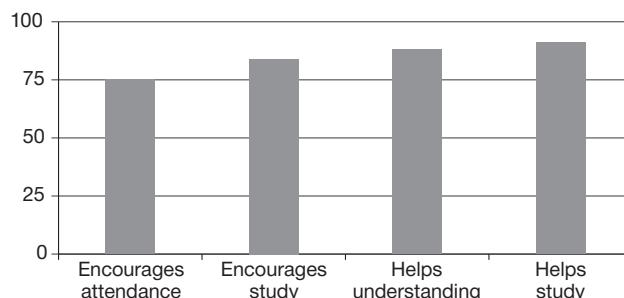
We feel that the activities mentioned above could have contributed to this increase in the number of students choosing our course.

As regards the video on the binding technique for understanding the concept of chemical balance, Dr. E. Claro, one of the teachers participating in this project, published the manuscript entitled: «Analyzing ligand depletion in a saturation equilibrium binding experiment» in the international journal on Biochemistry teaching Biochemistry and Molecular Biology Education, (Claro, 2006). We also saw how the implementation of the technique described in the video on the «Pharmacological Biochemistry» course and the opening of a *Forum* on the Virtual Campus coincided with an increase of over 50% in the number of people registering for the course. Despite there being no objective data showing a cause-effect relationship, it is possible to suggest that these activities may have contributed to this increase in students choosing the course.

4.2. Use of the Rapid Test (QQ)

In order to assess understanding of face to face sessions, (watching videos, theoretical classes and classroom seminars) experiments also took place on the educational usefulness of the «rapid test» type tool (currently included in the HPLC Video) during the 2005-2006 and 2006-2007 academic years, with students on the «Biochemistry of the Nervous System» and «Pharmacological Biochemistry» courses, in Classroom Practical Sessions and Seminars. In this activity, the teacher distributed several scientific articles on the given theoretical subject for class discussion, after a brief introduction by the teacher emphasising the points that he/she considered most important. A discussion then took place in which the teacher recorded the contributions made by students and the «Rapid Test» finally took place. An improvement in the students' academic performance and motivation was observed. In specific terms, this was: the final mark obtained by students in this test

Figure 2. Results of surveys on the usefulness of the Rapid Test (QQ) of Biochemistry of the Nervous System and Pharmacological Biochemistry students (2005-2006 and 2006-2007 academic years). Total surveys: 41

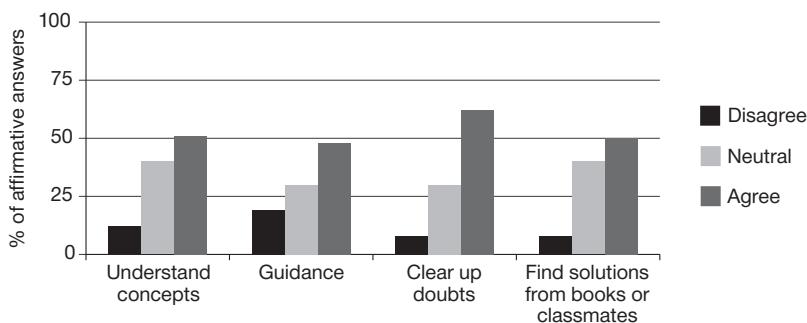


was excellent in all cases, and the results of a survey in two academic years of students in two second cycle subjects showed that over 70% of students thought that the «Rapid Test» had been useful to them (Figure 2).

4.3. Use of the Biochemistry questions database

Part of the Biochemistry questions database were used in the 2006-2007 academic year in order to complement teaching by means of supervised independent learning sessions (SILS). These are the basis for the Teaching Innovation experience which is being undertaken at the Medical Biochemistry Unit of the Biochemistry and Molecular Biology Department at the UAB. The results of an anonymous survey completed by 216 students out of a total of 344 who sat the second partial examination in June 2007 showed that over 50% positively rated the supervised independent learning activity, which includes the use of questions with corrected answers. (See Figure 3)

Figure 3. Results of the surveys on the usefulness of surveys SILS (supervised independent learning sessions) of Biochemistry and Molecular Biology students in the first year of Medicine. (2006-2007 academic year). Total surveys: 216



4.4. Other experiences: «Figurative Biochemistry Tales»

During the 2002-2003 academic year, students from a theory group on the «Biochemistry and Molecular Biology» course of the 1st year of Medicine (160 students in total) were invited to submit a «text commentary» on the article «A long, long time ago...» (Bootland, 1998) and to create what we called «Figurative Biochemistry Tales». Work was received from 40 students, of which more than 70% passed the course and over half did so with very good marks in the final grade. Their subjective assessment was very positive.

5. Conclusions

The use of the following activities and teaching items: *a*) projection of videos, *b*) «Rapid Test» of understanding, *c*) voluntary submission of a «figurative-metaphorical» task, *d*) establishment of a *Discussion Forum* on the experimental results in the Virtual Campus was valued very positively by the students and was seen to be correlated with improved academic performance by the students.

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Interesting links

The videos produced can be viewed via the video streaming server of the Faculty of Medicine Multimedia Resources Centre, where they are accessible from the Internet by means of the following URLs:

- <http://medic101.uab.es/qtmedia/media/hplc.mov> [2008]
- http://medic101.uab.es/qtmedia/media/hplc_2.mov [2008]
- <http://medic101.uab.es/qtmedia/media/qnb.mov> [2008]

Keywords

Biochemical techniques, chromatography, chemical balance.

Financing

This project was financed by the 2005 AGAUR program for the Improvement of Teaching Quality in Catalan Universities (ITQ) (identification number 2005MQD 0009).

Supplementary materials on the CD-ROM

Video of biochemical techniques and data bases of commented questions.

Project leader

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Presentation of the project leader

The head of the project, Dr. M.J. Sabrià, has participated in various teaching innovation initiatives for over ten years: these include the production of educational videos, advice on higher secondary education research work as part of the Argó Programme, producing supervised independent learning sessions, attendance at IDES training workshops and presenting communications to teaching innovation day sessions.

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