An example of introducing new technology at university classes

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Indique uno o varios de los seis temas de Interés: (Marque con una {x})

{ } Enseñanza bilingüe e internacionalización

{ } Movilidad, equipos colaborativos y sistemas de coordinación

{ **x** } Experiencias de innovación apoyadas en el uso de TIC. Nuevos escenarios tecnológicos para la enseñanza y el aprendizaje.

{ } Nuevos modelos de enseñanza y metodologías innovadoras. Experiencias de aprendizaje flexible. Acción tutorial.

{ } Organización escolar. Atención a la diversidad.

{ } Políticas educativas y reformas en enseñanza superior. Sistemas de evaluación. Calidad y docencia.

Idioma en el que se va a realizar la defensa: (Marque con una {x})

{ x } Español **{ }** Inglés

Resumen.

La utilización educativa de los videos en los campus, en los departamentos de todas las disciplinas está aumentando, desde artes, humanidades y ciencias a planes de estudios profesionales y vocacionales. El objetivo de este trabajo es presentar una experiencia docente desarrollada en la Universidad Politécnica de Cartagena y, más concretamente, en la asignatura de Métodos Numéricos para Ingenieros Agrónomos. Hemos utilizado videos en clase para enseñar nuestra asignatura. Los videos fueron realizados por nosotros. Se puede decir que nuestras clases eran una mezcla entre el sistema tradicional y el nuevo sistema educativo. Además, hemos intentado adaptar el proceso de evaluación al Nuevo Marco Europeo de Educación Superior. Hemos realizado un estudio comparativo entre las notas obtenidas por los estudiantes en nuestra asignatura, con el uso de videos en clase, y las notas obtenidas por los estudiantes en el resto de asignaturas de la carrera. Este estudio ha sido realizado durante cuatro cursos académicos y los resultados fueron muy positivos. Se detectó un aumento en la motivación e interés de nuestros estudiantes. También pudimos apreciar un aumento de la concentración de nuestros estudiantes

durante las sesiones de video. Lo anteriormente expuesto se vio reflejado en las calificaciones finales.

Palabras Claves: Marco Europeo de Educación Superior, videos en clase.

Abstract.

The educational use of video on campus is accelerating rapidly in departments across all disciplines from arts, humanities, and sciences to professional and vocational curricula. The aim of this paper is to present a teaching experience developed in the Polytechnic University of Cartagena and, more specifically, in the subject of Numerical Methods for Agricultural Engineers. We used videos to teach our subject at class. The videos were made by ourselves. Our classes were a mixed between the traditional system and the new educational system. Moreover, we tried to adapt the evaluation process to the new European Framework for Higher Education. A survey was carried out using video at class in order to compare our students' grades with the rest of university students' grades. We did the survey during four academic years and the results were strongly positive for both students and teachers. We could find an increase in motivation and in the interest of our students. We could also appreciate our student quite concentrated during the video sessions. The previous one was reflected in the final grades. In the future we are going to introduce e-beam at class and we would like to study the students' performance.

Keywords: European Framework, higher education, videos at class.

1 Introduction

Media, and video in particular, are in a period of profound transition, rivalling any we have ever been (Starr, 2004). Causes are various, but three stand out. Technology has rendered many of the processes of media creation, distribution, and consumption faster and less costly than ever before. Public expectations about the availability of media have grown to the point that many people consume and freely exchange media property each day in the course of their personal and professional lives. New companies, enterprises, and initiatives regularly exert game, changing influence in film and electronic media. YouTube, by posting 13 hours of video every minute, is one such player; Wikipedia, about to make video available in its entries on line via the open-source codec Ogg (Wikimedia, 2009),will be another. While a number of studies (Pew research center, 2000) have pioneered progress in the field of understanding the use of the Internet and web resources in educational and everyday life, the time is right to take a careful look specifically and take stock of trends in teaching and learning at the university level (Kaufman, 2009).

We describe our experience using videos to teach Numerical Methods to fourth year students of the Agronomical Engineering degree at the Polytechnic University of Cartagena. This proposal could be classified halfway between the classical teaching techniques and the new pedagogical proposals introduced to adapt teaching methods to the new European Framework for Higher Education. The innovation is focused on the use of teaching videos developed by teachers themselves as a

complement for classroom lessons. We try to study the effect of these videos on our students' grades.

In the paper, we attempt to describe our experience. In the first place, we perform a description of the subject. Secondly, we present stages in which the course is divided and the type of educational technique applied on them. Thirdly, we explain the type of evaluation followed and the grades obtained by students. After that, we show the teaching evaluation survey, the type of exam evaluated. And finally, we portray some conclusions.

2 A brief description of the subject

The course of Numerical Methods has a collection of lessons performed during the first semester of the fourth year (out of five) of the Agronomical Engineering degree. It represent 4.5 Spanish credits (45 teaching hours), of which 1 credit (10 teaching hours) is devoted to computer practice. It is the students' first contact with Numerical Analysis.

A summary of the course can be divided as follows:

1. Introduction to numerical analysis

2. Linear systems of equations

3. Non-linear systems of equations

4. Interpolation

5. Numerical derivation and integration

6. Introduction to the approximation of differential equations

Computer practice consists of the manipulation of MATLAB programs provided by the teachers of the subject.

3 Proposal Stages

The proposal was divided into three stages. The first stage was developed during the months of September and October (the first two months of the first semester in Spain).At this stage, the contents of the subject were introduced with lectures. Then workgroups of 2-3 people were formed, and personalized meetings were held with all the groups.

4 The type of evaluation and grading

The evaluation was split into two stages. During the first stage the students carried out a group assignment and later presented it in class. Group assignments consisted of going through the exams from previous years. These exams were based on solving several problems related to the different topics covered in the course, the study of three theoretic topics, and three MATLAB programs. The presentation

required the explaining of some problems, one theoretic topic, and one program, randomly chosen from afore mentioned exams. After the presentation, questions were asked by the teachers and the fellow student groups. The second stage consisted of a traditional exam. This test would be used by the student to raise the final grade or to try to pass the subject if the desired grade had not been attained in the first stage. Only one person each year, who in turn earned the maximum grade (First Class with Distinction, Matrícula de Honor), chose this option.

The grades earned by the 16 students enrolled in 2007-2008 were:

- 1 First Class with Distinction (Matrícula de Honor)
- 13 A's (Sobresaliente)
- 2 B's (Notable)

The grades earned by the 12 students enrolled in 2008-2009 were:

- 1 First Class with Distinction (Matrícula de Honor)
- 11 A's (Sobresaliente)

The grades earned by the 17 students enrolled in 2009-2010 were:

- 1 First Class with Distinction (Matrícula de Honor)
- 11 A's (Sobresaliente)
- 1 B's (Notable)
- 4 B's (Aprobado)

The grades earned by the 17 students enrolled in 2010-2011 were:

- 1 First Class with Distinction (Matrícula de Honor)
- 1 A's (Sobresaliente)
- 2 B's (Notable)
- 3 B's (Aprobado)

The grades earned by the 17 students enrolled in 2011-2012 were:

- 1 First Class with Distinction (Matrícula de Honor)
- 12 A's (Sobresaliente)
- 6 B's (Notable)

The grades earned by the 17 students enrolled in 2012-2013 were:

- 1 First Class with Distinction (Matrícula de Honor)
- 8 A's (Sobresaliente)
- 2 B's (Notable)
- 2 B's (Aprobado)

5 The teaching-evaluation survey

Since the academic year 2005/2006, annual teaching-evaluation surveys have been carried out for all subjects at this university. Below is a list of the grades earned, on a scale from 0 to 10, for this subject, including a comparison with the rest of the subjects.

We include the academic years from 2007-2008 to 2012-2013.

5.1 First year

Sample: 13 from 16

Results are shown in Fig. 1.

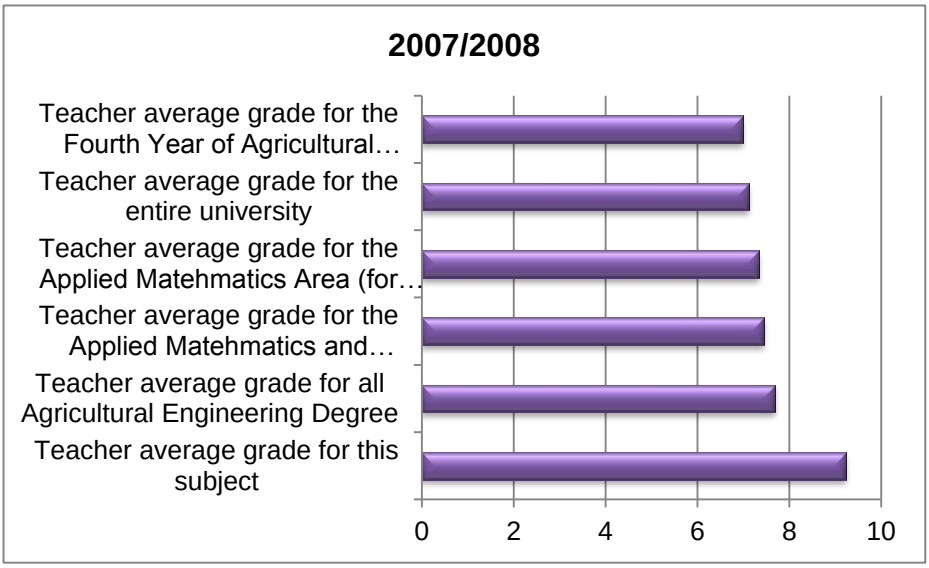

Figure 1. Results of the survey: 2007/2008 academic year.

5.2 Second year

Sample: 5 from 12

The results are shown in Fig. 2.

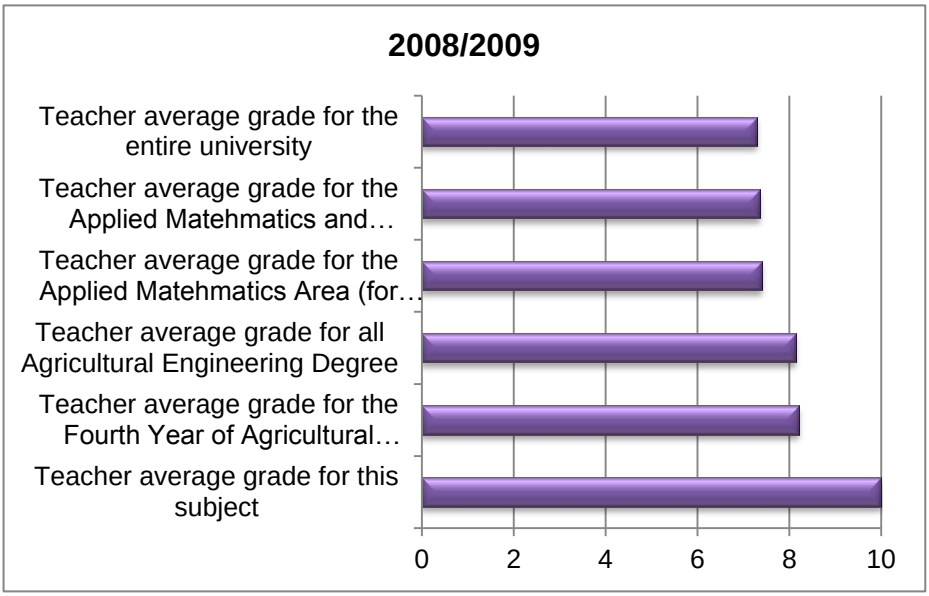

Figure 2. Results of the survey: 2008/2009 academic year.

5.3 Third year

Sample: 9 from 21

Results are shown in Fig.3.

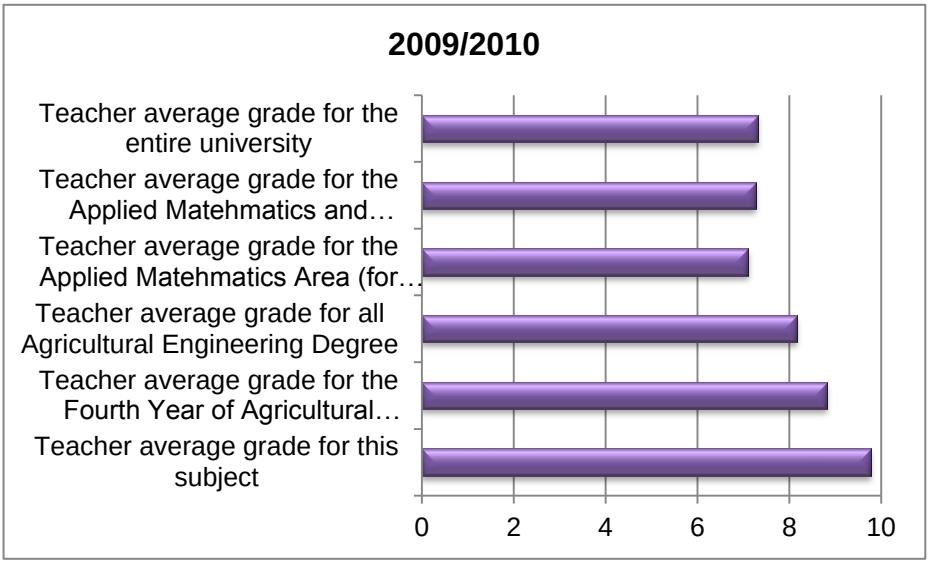

Figure 3. Results of the survey: 2009/2010 academic year

5.4 Four year

Sample: 7 from 9

The results are shown in Fig. 4.

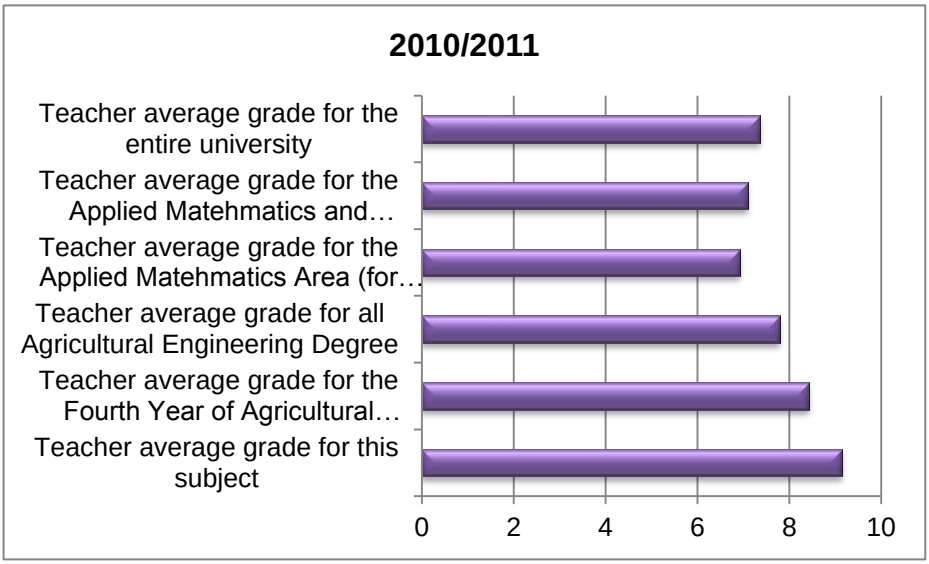

Figure 4. Results of the survey: 2010/2011 academic year.

5.5 Fifth year

Sample: 19 from 19

Results are shown in Fig. 5.

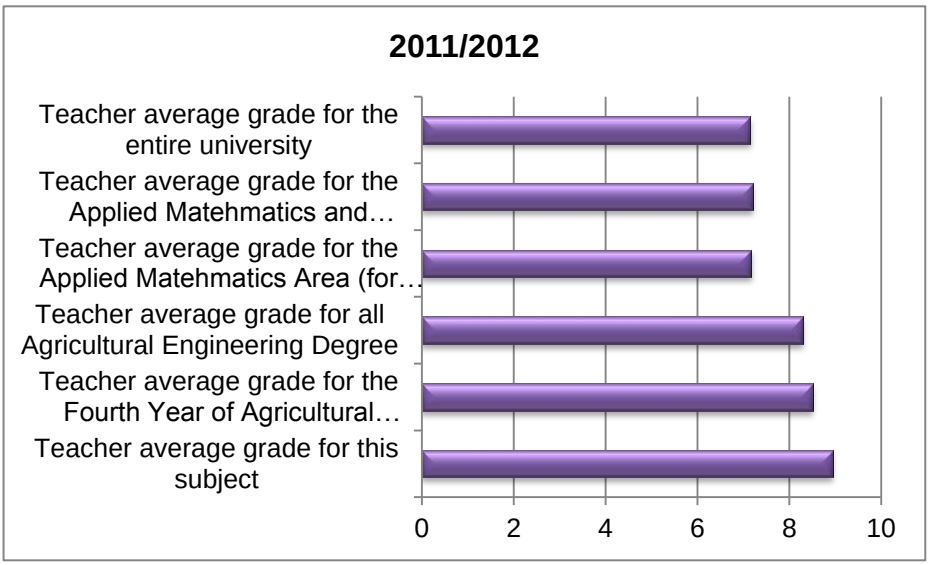

Figure 5. Results of the survey: 2011/2012 academic year.

5.6 Sixth year

Sample: 7 from 13

Results are shown in Fig. 6.

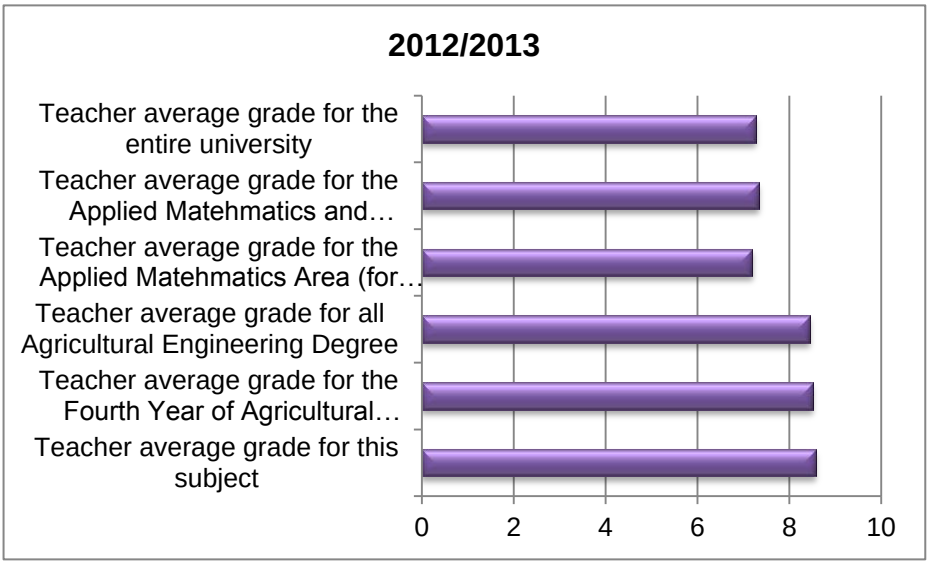

Figure 6. Results of the survey: 2012/2013 academic year.

6 Exam

Finally, we include one of the exams containing the type of problems, theoretic topics, and programs that students have to explain in his presentation.

1) Let us consider the Cauchy problem:

$$y' = y.t$$

$$y(0) = 1$$

Using a predictor-corrector method give an approximation to $y(2)$ taking $h = 1$.

2) Find the Lagrange polynomial that interpolates the function $f(x) = x^3$ at the points $x_0 = 0, x_1 = 1$ and $x_2 = 2$. Estimate the approximation error.

3) Estimate the lest number of intervals that we have to use in the method of Simpson in order to obtain an approximation of

$$\int_0^1 e^x x^5 dx$$

with an error less than 10^{-6}.

4) Use Newton's method, starting from $x_0 = 2$, to approximate the positive solution of $x_2 = 0$. Estimate the order of convergence and explain the results.

5) Starting with $x^0 = (1,1)^t$ obtain an approximation, using the method of Gauss Seidel, to the solution of

$$x_1 + 3x_2 = 2$$

$$4x_1 - x_2 = 8$$

What is the error in each step?

6) Newton's method for nonlinear equations.

7) Approximate $y(T)$, using a m-file for the Euler method, where y is the solution of

$$y' = cos(y) + t$$

$$y(0) = 1$$

7 Conclusions

The teaching experience described is a hybrid between the classical teaching methods and the innovative strategies needed for study plans in the future. The greatest innovation was the use of teaching videos, and the possibility to pass the subject by carrying out and presenting group assignments. The results achieved by the students and reflected in the teaching evaluation of this subject have been very encouraging.

This information is without a doubt stimulating.

Bibliography and References

Kaufman, P. & Mohan, J. (2009). Video use and higher education: Options for the future

Pew Research Center (2000), at http://www.pewinternet.org/reports.asp

Starr, P. (2004). The creation of the Media: Political Origins of Mass Communications, at http://books.google.com/books?id=KO30kMoLKKkC

Wikimedia (2009), at http://blog.wikimedia.org/2009/01/26/mozilla-and-wikimedia-join-forces-to-support-open-video/