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EXPERIENCE IN THE TEACHING OF BASIC SUBJECTS APPLIED TO AGROFORESTRY

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Abstract.

Applied Statistics and Technical Drawing may be regarded are a basic as well as technical subject in engineering, and therefore play a central role in the agro-forestry engineer professional curriculum. With the purpose of implementing a new learning method, within the framework of European Higher Education, an experimental evaluation was organised along in the academic year 2004/05 for students at the Faculty of Forestry Engineering in the Madrid Polytechnic University. The teaching methodology goal was to improve students' oral information searching, use of technologies and analysis and synthesis capacities, while, at the same time providing them with a basic knowledge about the subject.

The results by using this method in Technical Drawing are rather significant. As the table below illustrates, the number of PASSES per year increases up to 38% if compared with the data of the previous year. Consequently there is a considerable improvement (16%) in the average mark of these students.

The results by Applied Statistics are following: , the number of PASSES per year increases up to 35,8% if compared with the data of the previous year and the average mark increases up to 12,5%.

Keywords. Education; new methodology; Applied Statistics; Technical Drawing; Agroforestry

1.- Introduction

This work presents the results and conclusions achieved after having applied the teaching and assessing methodology accomplished on the first-year subject Technical Drawing and the third-year subject Applied Statistics (Ayuga,2002, Ayuga et al., 2002a) both belonging to Forestry Engineering Studies, throughout the academic year 2004/2005 (Ayuga and González, 2005; Ayuga et al, 2005). The aim of this methodology is the improvement of the learning strategies for both subjects, the acquisition of a series of skills and more accuracy in the real time required for students to carry out their work out of the classroom. In this way, we will better know the teaching aspects to be improved, modified or eliminated in the next years and so a better estimate of the number of European credits(ECTS) (González et al., 2002) required for these subjects once the new curricula are prepared.

2.- Method

Due to the different characteristics of both subjects, the methods used, though similar, are described separately.

2.1.- Technical Drawing

The number of students registered in this subject for the academic year 2004/2005 was 106. After having given them some information about the teaching methodology and the norms of assessment for the two partial examinations the subject is divided into, the number of students who decided to collaborate in the experience were demanded to answer, in a reliable way, the questionnaires and surveys presented, and to try to time their work on the subject.

Counting with a reference group within the same academic year would have been ideal in order to compare results, but, since all the students decided to participate in the experience (except two students who eventually did not take the final examinations), the final results were compared with the results of the previous academic year, that is 2003/2004, in which the number of registered students was 155.

The in-school period was from 27th of September to 19th of May of 2005.

First quatrimester: from 27th of September to 3rd of February (first partial exam). Four thematic units were explained: 1. Basics on AutoCAD 2002, 2. Elementary Geometric Constructions, 3. Sketching, 4. Introduction to the Diedric System.

Second quatrimester: from 3rd of February to 19th of May (second partial exam). Three thematic units were explained: 1. Representation of Single Items in Isometric. 2. Representation of Single Items in Perspective 3. Plan Making and Mapping Applied to Agroforestry.

The teaching of the subject consists of two two-hour sessions each week. The sessions took place in the Computer Room with availability for 30 students working individually.

The teacher explains the theoretical contents in each session for around 20-40 minutes. The remaining 80-100 minutes are devoted to the practical task proposed. Each practical task has a deadline for its realization, usually at the end of the session, but occasionally it is necessary to extend the deadline and so the students are demanded to work out of the classroom. The practical tasks can be delivered through Internet and therefore, the student can follow the possible incidents as well as know the final mark and comments of the teacher. In addition to these practical tasks, the students are proposed two integrative team works, one per each partial exam, consisting in field work and their subsequent continuation in the study. In addition

to the practical tasks and the compulsory works, the students are also proposed voluntary practices.

The traditional method of assessment consisted in one exam per each quatrimester that included exercises of the type:

First Quatrimester:
Test of the theoretical contents explained in class (weighing 0.3)
Computer sketching (weighing 0.35)
Projections, Diedric system, delineation using computer tools (weighing 0.35)

Second quatrimester:
Test of the theoretical contents explained in class (weighing 0.2)
Perspective drawing by computer tools (weighing 0.35)
Cartography and plan edition: mapping or mapping with computer tools (weighing 0.45)

Every exercise was marked from 0 to 10. The mark required to pass the exam was equal to or higher than 5 in two thirds of the exercises proposed, and, in any case, equal to or higher than 3 in any exercise. In this way, the pondered average of the marks would be equal to or higher than 5.

The same thematic units were explained throughout the academic year 2003-2004, and the same method of assessment was followed.

The students following the continuous assessing method must take the first test, that is to say, the test including the theoretical contents, and deliver at least 90% of the compulsory practical tasks before the deadline. The final mark is obtained similarly and with the same criteria as the traditional assessment method aforementioned. In other words, the average mark obtained from the practical tasks substitutes the mark of the exercises 2. and 3.included in each exam.

2.2.- Applied Statistics (2nd semester)

The number of students registered in this subject for the academic year 2004/2005 was 130. After giving them some information about the teaching methodology and the norms of assessment for the two parts the quatrimester is divided into, i.e., a third partial term including statistics inference topics, regression models and variance analysis models, design of experiments, and a fourth partial term including sampling techniques specifically applied to the forest sector, the number of students who decided to collaborate in the experience were demanded to answer, in a reliable way, the questionnaires and surveys presented and to try to time their work on the subject.

The group of students who preferred to follow the traditional method (attendance to classes and final exam) was the witness group to compare results. The results of the experiment hardly affected the final mark of the student.

The in-school period was from 1st of February to 19th of May of 2005.

The period corresponding to the third partial exam was from 1st of February to 17th of March and the following three thematic units were explained: 1. Point and Interval estimate, error estimate and sampling coverage; 2. Estimate and testing of parametric, non-parametric, and hypotheses; 3. Variance analysis, lineal and advance regression. Design of experiments.

At the end of each unit the students were delivered, with no former notice, a test-type questionnaire that was corrected in class (self-evaluation) and subsequently given back to the teacher. In order to complete the final mark for the unit the student had to present and expose a work of his, and so the evaluation was followed like this:

Table 1. Final marks per concept, third partial period:

CONCEPT	***Every unit***	***TOTAL***
Work	0 – 1.5	0 – 4.5
Dissertation/Discussion	0 – 1.5	0 – 4.5
TOTAL	0 - 3	0 - 9

The period corresponding the fourth partial exam was from 29th of March to 19th of May and the units exposed: 1. Basics on survey sampling; 2. Traditional sampling models; 3. Other types of sampling. The methodology followed was the same one used in the previous partial term but, due to the fact that the units were more practical and that the theoretical concepts were the ones studied throughout the whole course, the students were demanded a unique work in which the three thematic contents were applied to a real situation with real population and limited size. The assessment model was as follows:

Table 2. Final marks per concept, fourth partial period:

CONCEPT	***TOTAL***
Work	0 – 4
Dissertation/Discussion	0 – 2
Optional Section	0 - 2
TOTAL	0 - 8

Seven practices were carried out by using the computer; the outlines of the practices included the solving of problems related to the units explained in the quatrimester (the practices with computer of the first partial term would be useful to accomplish the sampling work). The attendance and realization of the practices in each partial term were marked from 0 to 10. The attendance to the class in the fourth partial term was also evaluated from 0 to 10.

3.- Results

3.1.- Technical Drawing

Table 3. Student results in year 2004/05 and year 2003/04

YEAR	REGISTERED STUDENTS	ABSENT	PASS – Throughout the Academic Year	AVERAGE MARK	PASS – Final exam	AVERAGE MARK
2004-2005	155	30	56	6.3	42	6.07
2003-2004	106	2	78	7.9	13	6.95

Total percentage of passes over the number of students who took the exam:

ECTS Group 85.85% Reference Group 63.22% Increment 22.63%

Percentage of passes per year:

ECTS Group 75.58 Reference Group 36.12% Increment 37.46%

Final average mark in the academic year

It is noticeable a significant increase of the average mark per year, i.e. from 6.3 to 7.9. However, it is unimportant the difference in the final exam regardless its sligt increase from 6.07 to 6.95.

The first quatrimester accounted for a total of 27 classes and the second quatrimester for 27, being a total of 112 hours distributed as it follows:

In the classroom

25% for dissertation and questions about the theoretical contents

68% for compulsory practical tasks

7% for team-work

Out of the classroom

Average time necessary to complete the individual work: 52 hours (CV 20%)

3.2.- Applied Statistics

Summary of marks in the third partial exam (2004 – 2005)

Table 4. Summary of marks in the third partial exam 2004/05

Tipo	n	x	Me	s_{n-1}	e	CV
Ects	72	8.1	8.1	0.648	0.076	8.1
Group reference	30	4.4	4.3	1.928	0.352	43.5
absent	28					

Percentage of passes

ECTS Group 100% Reference Group 33.3%

Average time necessary to finish the works . 76 hours (CV 40%)

Summary of marks in the fourth partial exam (2004 – 2005)

Table 5. Summary of marks in the fourth partial exam 2004/05

Tipo	n	x	Me	s_{n-1}	e	CV
Ects	96	6.2	6.3	0.801	0.082	12.9
Group reference	8	5.9	5.5	1.280	0.452	21.7
absent	26					

Percentage of passes

ECTS group 100% Reference group 87.5

Average time necessary to finish the works . 23 hours (CV 40%)

Total hours for the fourth quatrimester (that is, both third and fourth partial exams): 75 class hours

14 hours for practice tasks using computer tools

18 hours for the solving of problems

21 hours for oral presentations of the works

22 theoretical hours

4.- Conclusion

The number of failures decreases enormously, above all if we only consider the in-school period and both partial examinations. In other words, most of the students do not have to make an overeffort since there is no need to take a final exam.

There is a slight increase in the average mark of the students who passed per academic year (16% in Technical Drawing and 20% in Applied Statistics). However, that difference is not significant if compared with the marks obtained in the final exams.

The students valued the method highly. They felt more motivated and their implication in the subject was also higher. Nevertheless, they considered that the method was more time-demanding.

The teacher achieves a deeper knowledge of the learning level acquired, both quantitatively and qualitatively, and the attention devoted to the students is more specific. Moreover, the learning skills increase considerably.

The estimate realized was based on the information the students provided about the number of hours required for each subject out of the classroom.. If we consider this data as a whole along with the number of in-class hours, the traditional system of credits can be transformed into the new system of European credits, taking into account that 1 Ects credit corresponds to 25 – 30 working hours per student.

Technical Drawing: 12 traditional credits become 7 European credits.

Applied Statistics (2nd Semester): 7.5 traditional credits become 4 European credits.

Overall, the experience was so positive that, for its revision and improvement we have applied it again in the current academic year.

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