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The Clickers as a Teaching Tool in University Education: Analysis of Its Impact on a Dual Degree Program from the Universitat de València

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Abstract

In the 2010-2011 academic year, the degrees and Dual Degree Programs (DDP) were implemented in Spanish universities, following the guidelines of Bologna and under the protection of Royal Decree 1393/2007, of October 29. The degrees and DDP with a duration of four and five years, respectively. Thus, as of 2014 and 2015, the first promotions of graduates resulted. Both in one case (degrees) and in the other (DDP), and in order to adapt to the characteristics of the new study plans, the methodology used by the teaching staff has undergone important changes. The increase in the use of Information and Communication Technologies (ICTs) is, among these changes, one worthy of mentioning.

In views of a probable new revision of the study plans, which would change the duration of these degrees to 3 years, it now seems to be the moment to carry out an assessment of the effects that these tools have had on the teaching-learning process. This would allow spotting the strengths and weaknesses of such tools and proceed, if deemed appropriate, to their redesign and implementation in the development of the classes.

Thus, in this work the impact that one of these ICTs has had on one of the DDP offered by the Universitat de València is analyzed, at both a descriptive and inferential level. Specifically, attention is focused on the impact that an Electronic Voting System (EVS), the Clickers, has had on the development and academic results of the students of the first promotion of one of the DDP offered by the Universitat de València: the double degree of Turismo-ADE, which began its journey in the 2014-2015 academic year.

To do this a random sample is resorted to. The results point to a very good performance of the students as a result of the implementation of this tool, as well as a satisfactory reception of it. Indeed, an approved percentage of 76% was achieved over a 100% students assistance, while the average rate given by the students regarding the methodology used was 4'83 (out of 5).

Keywords: *ICts, Electronic Voting System, Clickers, Dual Degree Programs, descriptive analysis, inferential analysis*

1. Introduction

The implementation of the degrees from the 2010-2011 academic year in Spanish universities was carried out under the protection of Royal Decree 1393/2007 of October 29, which included both degrees and Dual Degree Programs (DDP).

In order to adapt to the new study plans the methodology used by the teaching staff has undergone important changes. We must not forget that, in addition, the so-called "digital native" generations are incorporated into the classrooms, which is why there has been a significant increase in the use of Information and Communication Technologies (ICTs).

Some studies show the good results that their use produces in the development of the teaching-learning process [1, 2, 3, 4].

These ICTs include the Clickers, an electronic voting system (EVS) that allows real-time feedback from the audience and has also shown good results in both undergraduate and master's degree studies [5, 6, 7, 8].

It should be noted that this EVS allows [9]:

- Increasing student attention and participation
- Achieving records in attendance in the class.

Thus, the work that is presented studies, on a descriptive and inferential level, the repercussion that the use of Clickers has had in the teaching of a subject of quantitative cut in one of the DDP offered by the Universitat de València, the double degree in Tourism- ADE.

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What motivates this study is the fact that said DDP, which began its journey in the 2014-2015 academic year, did so with an added difficulty: the heterogeneity of the students in their quantitative pre-university education, originated by the student's different ways to access. Regarding this, the students could access having pre-registered, previously, in the Tourism degree or in the ADE degree and their profiles in one or the other degree did not coincide (in terms of pre-university studies).
As a result of the heterogeneity detected, the faculty responsible for the subject "Introduction to Statistical Inference" decided to use the Clickers. Specifically, three surveys were carried out, programmed once a series of topics had been taught that comprised, respectively, the blocks of: "Central Theorem of the limit", "Estimation" and "Contrast".
Thus, in the present work the results obtained with the use of this EVS will be analyzed, seeking to validate its use both during the delivery of the subject and in the final results.

2. Methodology

While empirical information has been obtained through the use of random sampling [10], the methodology used will combine descriptive and inferential techniques. Thus, the descriptive tools used will be numerical (reduction measures) and graphical (bar diagram). When the descriptive analysis suggests it, inferential tools will be used to analyze the significance of the observed differences. In this specific case, where the intent is to analyze the results of the different surveys conducted with the Clickers, the Analysis of the Variance (ANOVA) will be used to test the hypothesis that the average percentage of correct answers is the same in the three soundings. For this, the starting hypotheses will be verified previously, this is the Normality and Homocedasticity of the populations. The Kolmogorov-Smirnov test will be used to verify the first of the hypotheses exposed and the Levene test for the second one.

3. Results

In the present epigraph, the results obtained will be presented, distinguishing between descriptive and inferential analysis.

3.1 Descriptive analysis

Table 1 includes some of the most relevant summary statistics of the percentage of correct answers in each of the three probes.

Table 1. Summary statistics.

	1st Session	2nd Session	3rd Session
Average	35,65%	67%	66%
Typical dev.	35,77%	29,81%	16,06%
Pearson V.C.	1,003	0,4422	0,2423
Median	15,38%	77,38%	63,04%
Minimum	0,00%	0%	44,00%
Maximum	92,00%	96%	92,00%

Source: own calculations

From its observation the following is concluded:

- A noticeable increase in the average percentage of correct answers between the first and second surveys (from 35,65% to 67%), and a slight decrease between the second and third surveys (from 67% to 66%).
- A similar situation with the median, which remained high in the last two surveys. Specifically, 50% of the students guessed a minimum of 77% of the questions in the second survey and 63% in the third, percentages well above 15% of the first survey.
- A clearly decreasing trend of the value of the Pearson coefficient of variation, which implies a greater representativeness of the mean and a homogenization of the level of knowledge of the students.

- The minimum percentage of correct answers shows an important increase in the third survey, standing at 44%, that is, the students who obtained the worst results correctly answered 44% of the questions. Figure 1, which shows this evolution, allows to visually verify this.

Figure 1. Evolution percentage of the minimum of correct answers

Source: own calculations

3.2 Inferential analysis

Based on the results of the Kolmogorov-Smirnov test (tables 2, 3 and 4) and the Leven test (table 5)

Table 2. Kolmogorov-Smirnov test for percentage of correct answers in the 1st Session.

Population Parameters		Statistic D	P-value
Average	Typical deviation		
35,65%	35,77%	0,297	0,172

Source: own calculations

Table 3. Kolmogorov-Smirnov test for percentage of correct answers in the 2nd Session.

Population Parameters		Statistic D	P-value
Average	Typical deviation		
67%	29,81%	0,213	0,200

Source: own calculations

Table 4. Kolmogorov-Smirnov test for percentage of correct answers in the 3rd Session.

Population Parameters		Statistic D	P-value
Average	Typical deviation		
66%	16,06%	0,174	0,200

Source: own calculations

Table 5. Levene test for equality of variances for percentage of correct answers

Levene statistic	Degrees of freedom 1	Degrees of freedom 2	P-value
4,047	2	24	0,031

Source: own calculations

It is concluded that, according to the P-values, Normality (for any level of assignable significance) can be assumed for the three populations defined by the percentage of correct answers in the surveys, as well as homoscedasticity of said populations, for a level of significance less than or equal to 3%. Once the verification of the starting hypotheses has been verified, an ANOVA is carried out, the result of which is shown in Table 6

Table 6. Results of ANOVA for percentage of correct answers

	Sum of squares	Degrees of freedom	F	P-value
Inter-groups	0,398	2	2,604	0,095
Between groups	1,832	24		
Total	2,230	26		

Source: own calculations

Concluding that for a level of significance greater than 9,5%, it is rejected that on average the percentage of correct answers has been the same in the 3 surveys.
Thus, according to Table 1, it can be deduced that said rejection reflects an improvement in the learning process, as the percentage of correct answers shows an increasing evolution, with an increase in the homogeneity of the students, taking into account the decreasing evolution of the Pearson coefficient of variation.

4. Conclusions

The analysis that the impact of the use of an EVS, the Clickers, has had in a DDP of the Universitat de València, allows concluding that their use leads to a better evolution of the learning process, as the percentage of correct answers has increased or almost stabilized throughout the tests (35,65%, 67% and 66%). Furthermore, the heterogeneity of the group has been reduced, as indicated the decreasing trend of the Pearson coefficient of variation (1,033, 0,4422 and 0,2423 respectively).
These differences, detected at a descriptive level, are significant, as reflected in the inferential techniques used.
Regarding the final result obtained, it should be noted that the use of Clickers has been a significant improvement in terms of academic performance, as the rate of submission, in first call, was 100% with 79% approved. In addition, this ICT had an excellent reception by the students, as reflected by the score they gave it (4,83 out of 5), according to the surveys carried out by the Quality Unit of the Universitat de València

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