

TEACHING PROBABILITY AND STATISTICS WITH *E-STATUS*

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In the last few years, the subject Probability and Statistics in an Engineering Programme has incorporated different strategies that impacted on student retention. In addition to the significant increase in the rate of approval at the end of the course, a positive trend in the perception of the students about the difficulty of the subject was also evident. During 2015, a baseline with the use of the current version of the platform named 'e-status' has been designed in order to establish the future impact. For this, problems related to probability were assigned on the platform. The results were analyzed considering conceptual difficulties, appreciation of the platform and the degree of usage. The data collected shows that the majority of the students had resolved only the minimum set of problems, thus it is necessary to continue with the monitoring by the teacher in the process of self-regulated learning.

INTRODUCTION

The importance of statistics for professional work in many areas is indisputable, particularly in Engineering. In the case of Probability and Statistics for Engineering programmes at National University of La Matanza, UNLaM, there have been historically high rates of student failures at examinations during the course. Some difficulties lies in the lack of probabilistic-statistical culture (Batanero et al, 2011; Garfield, J., Ben-Zvi, D., 2009).

Since 2009, the chair of the subject Probability and Statistics decided to devise new teaching strategies, offering the students different tools which would allow them to both improve the learning and modify their perception about any difficulty. They have incorporated new teaching strategies in order to improve pass rates (Giuliano et al, 2011; Pérez et al, 2013).

In an attempt to maintain the theoretical and practical format of the classes, teaching strategies for problem-solving, which were optional for the students, have been added: face-to-face workshops, virtual forums for discussions and a web platform with self-assessment. This platform, called e-status, was created by a group of researchers from the Department of Statistics and Operational Research of the Polytechnic University of Catalonia (DEIO-UPC) to encourage the learning of probability and statistics topics , (González et al, 2010).

E-status is a web-based tool designed to support a learning project led by a team of teachers to assist students in learning statistics. This is a tool that is able to display statistical or mathematical problems and to correct the students' answers. The problems may include random data, so the solution cannot be previously known (if solved beforehand), and the student can reconsider the problem if necessary. E-status uses Open Source informatics technologies and executes the associated code in the R software to automatically generate and solve problems proposed by the teacher for a specific subject and available for students through a web site. Since 2013, researchers and teachers from UPC and UNLaM formed a work team for the development and improvement of the platform (Videla *et al*, 2014).

This article presents the outcomes of the 2015 e-status platform implementation, taking into account that students had the requirement to solve at least a minimum of one exercise. Hence, it represents the baseline to future implementations. For the definition of baseline, some qualitative and quantitative variables were analyzed considering number of interventions, their depth and the general opinion about the platform. As the platform allows the registration of whatever activity performed by students, their interactions in it were analyzed quantitatively. The parameters considered were conceptual difficulties, perception of the platform and degree of usage frequency.

The purpose of this report is to present the findings of the first phase of a research study on the impact of the changes in teaching and learning strategies in a course on Probability and Statistics. The findings constitute a baseline against which findings from future studies can be compared.

METHODS

The academic impact, understood as the intellectual contribution to one's field of study within academia (Penfield et al, 2014), of the implementation of the new strategies are evaluated from students' perspectives. It should be noted that the e-status platform allows quantitative analysis in accordance with the students' requirements for exercising, the number of times they try to solve the problems and the results they get. The students are expected to enter the platform and solve at least one exercise, whether or not they get to the expected result, before the Probability exam is taken.

The approaches adopted are mixed, qualitative and quantitative (Cook, T.; Reichardt, C. 1986), with interviews, surveys and registers analysis. Personal interviews as well as surveys were carried out with teachers and students, in order to learn about their opinions, and a register analysis of the teachers' impressions about the students (condition of approval and workshop, forums and e-status participation) was also administered.

The platform is meant to be a teaching tool which gives the teacher multiple possibilities: designing exercises that include statistical or numerical calculation, parameterizing the statement, grouping exercises to approach different topics and/or educational components, suggesting or guiding in case of wrong answers, assigning differential problems, following pedagogical standards and schedule flexibility, among other advantages. Furthermore, it allows the monitoring of students' homework, even in large groups, accessing not only the historical use of the e-status of the students but also the analysis of tools for the executions of each problem.

RESULTS

During 2014, it was decided that the e-status definitive installation in UNLaM would own servers, after having a positive experience in the use of such a tool, in its pilot format, in Probability and Statistics subject of UNLaM. Taking into account the results from surveys submitted to all of the participating students during the implementation of the platform, a considerable percentage of informants considered it a useful medium to complement their education. Nevertheless, there was a small group of students who showed little interest in the use of technological resources.

In the first course of 2015, from the total number of enrolled students (384), only 218 had registered to the e-status, 146 took the exam and 103 passed it. In turn, 75 students responded to the survey, which was administered after the students learnt their exam marks. During this implementation of the platform, students were able to choose between twenty exercises, each of them with various

items, related to varied topics of Probability and Statistics. Greatest difficulties were found in conditional probability topics, among others.

In figure 1, the number of problems that students solved are represented in the grey bars. It can be observed that 108 students solved the minimum required and 68 did not solve any problem, while 110 students solved two or more problems, with a maximum of 16 executions, with an average of 2.4 in the quantity of resolved problems. As regards the total executions carried out, that is to say, the number of times that students used the e-status to solve a problem, the average was 3.6, reaching a maximum of 23 executions in all. Fifty-six per cent (56%) of students did only one execution per solved problem; on average, one out of five did between one and two executions per problem, while 16% made two executions and the rest (8%) more than two per problem.

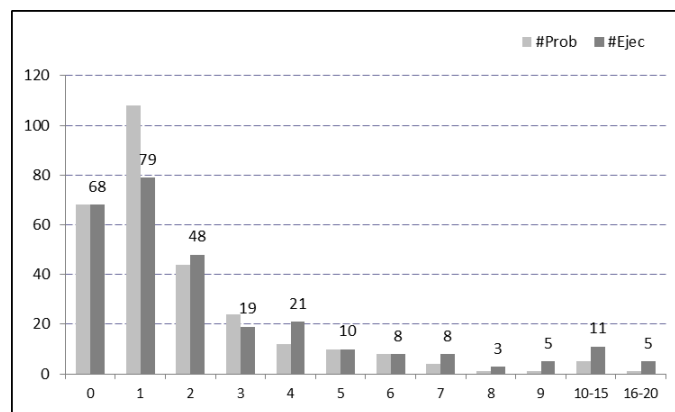


Figure 2: Number of executions and problems solved.

Those students who better valued the platform were those who had little studying time for job reasons, thus it was difficult for them to attend the face-to-face workshops. At the same time, they criticized the length of the proposed exercises and the impossibility to try to resolve the problem again with the purpose of correcting mistakes. Furthermore, they remarked basic situations of usability.

The possibility to adapt the platform to technology allows us to attend the teachers' and students' needs in terms of its optimal use for Probability and Statistics, which will, in turn, lead to a major development of its potentiality.

DISCUSSION

We believe that progress has been made in defining a baseline, which had been partially established.

In view of the results analyzed, we believe it is necessary to continue with the adaptation of methodologies to accompany the students during the self-regulated learning process. We consider that the use of the e-status platform during 2015 will allow us to draw our attention to those students who demonstrated a more passive role while interacting in the forums. The teacher's goal will continue to be to get the students involved in the course, so that they will be able to assimilate and process the new knowledge.

Acknowledgments

Last names of the authors in the order as on the paper

This work has been developed under research project C172 DIIT- UNLaM.

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