Teaching Statistics: An example of “How to” improve student’s statistical skills by performing individualized assignments

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Sweave is a well known tool that allows to embed code in LaTeX documents. We applied this technique to create individualized assignments to students in four disciplines taught in two different universities:

- Human Nutrition (HN). University of Lleida, Spain.
- Medicine (ME). University of Lleida, Spain.
- Nursing (NU). Autonomous University of Barcelona, Spain.
- Occupational Therapy (OT). Autonomous University of Barcelona, Spain.

For each discipline we choose a clinical trial (CT) in some way appealing and related with the specific discipline (Figure 1). The main results of those CTs were simulated to create an spreadsheet, one for each student of each course: 62 HN, 60 ME, 177 NU and 76 OT. (Figure 2-3)

Data were similar but different for each student in the discipline. So each student received a spreadsheet with his/her particular data and a PDF with his/her name and id. The PDF consists of 50 questions to apply on his/her spreadsheet covering all material taught during the course.

Questions and the way to solve them were exactly the same in each discipline students, but conclusions could be the same, similar or absolutely different depending on his/her data.

Questions consist on open questions that require to calculate a figure (i.e. a Student t statistic) as well as multiple choice questions. The answers for the late were randomly ordered. So not only conclusions could be different, even if the conclusion was the same, the choice could be a different item. (Figure 4-5).

At the end of the quarter students did a final exam. We compare the results of the final exam in each discipline, applying the new system against historic exams performed in 2006-07 and 2007-08. Exams were made with the same teachers and solved for similar students but not using individual assignments method. Results were extremely dramatic: As example, in NU discipline the final exam was done and approved for 57.2% of 187, and 52.2% of 186 students in the academic course 2006-07 and 2007-08 respectively, while 70.6% of the 177 students approved the exam in 2009-10 course (Figure 7).

Although the percentage of students who did the exam was fairly similar, the ones who did the exam, got higher marks: Mean (SD): 5.50 (1.94), 5.99 (2.12) and 7.43 (1.54) and approved a higher percentage: 65.6%, 67.1% and 91.9% (Figure 6).

Each student received a detailed answer, of course depending on his/her data. Students were asked about strengths and weaknesses in relation to assignment. The results of this analysis, got from open questions of the type “positive / negative” about the assignment with qualitative research methodology, has led to descriptions and interpretations of the experience of the student in learning statistics on a context of innovation. It has also identified those aspects of the subject more vulnerable and susceptible of being improved in future courses.

Figure 2: Functions to simulate data

Figure 3: Making data

Figure 4: An example of Clinical trial choose for nursing

Figure 5: Example of a question that:
- requires to calculate a figure
- and a multiple choice question

Figure 6: Example of answer received after delivery (question 1)

Figure 7: Exam results by period

Figure 8: Students marks by period

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