

# Online Materials for Practicing and Evaluating Statistics Knowledge *e-Learning Formative Evaluation in Computer Practices*

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**Abstract:** Auto-learning and self-evaluation are two main topics in ECTS environments. In this framework, new technologies are widely used to develop online tools which provide students the possibility of practicing and evaluating their learning progress. With this idea, guided practical for the application of the basic statistical techniques on a computer and self-evaluation tests have been developed for students of Physiotherapy Degree within a Learning Innovation Project supported by the University of Jaén (Spain). This paper reports our experience in the implementation of this learning material and evaluation practice in the teaching-learning process during the last academic year.

## 1 INTRODUCTION

From the development of the European Higher Education Area (EHEA), a new university learning system has arisen where new technologies are widely used in an educational model more focused on the student (see, e.g., Jolliffe et al., 2001; Martínez et al., 2010; Jiménez et al., 2011; Craig, 2012). In this model, the teaching-learning process is the heart of education, where the teacher, the learner, the curriculum, among other variables, are organized in a systematic way to attain predetermined goals and objectives (Bissa and Sharma, 2010).

Information and Communication Technologies (ICTs) constitute an unbeatable tool to prepare students in the use of statistical knowledge for the analysis, diagnosis and resolution of problems. In fact, a great effort has been made to elaborate learning materials which support the teaching presence and make the learning process more attractive to students. In this framework, the auto-learning and self-evaluation are two main topics in ECTS environments that motivate to develop novel tools that help students in their teaching-learning process (see, for example, Caballero et al., 2005; Olmo et al., 2009; or Jiménez et al., 2011, among others).

On the other hand, Statistical Software obviously is a computer tool less commonly used by people but very useful to process statistical data. In fact, the use

of this type of software allows the practical application of the techniques exposed in the theoretical lessons and prepares students to their future professional activity (Godino, 1995).

For these practices on computer, it is really useful for students to have support materials helpful in their teaching-learning process.

With this idea, and within a Learning Innovation Project that is being developed in the Physiotherapy Degree of the University of Jaén in Spain, we propose guided practical to solve questions related to those statistical techniques that have been studied in master classes, hence they practice with the contents of the subject avoiding calculus and focusing on interpretations of results.

Moreover, an important part of guided practices is “checking for understanding”. Different researches on formative assessment and feedback have shown how these processes can help students in their own learning. For that, it is necessary that teachers organise assessments and support learning which promote an active rather a passive role of the student in this task. Examples of evaluation systems encouraging the automatic feedback can be found in the literature (Wang, 2012); (Queiros and Leal 2012); (Nicol and Macfarlane-Dick, 2006)

In this framework, self-evaluation tests allow the student to check how the learning procedure is carrying out. This provides a feedback for students because, once they have finished the test, they can see the obtained score and the correct solution for

each question. The objective is to provide students of Physiotherapy Degree an opportunity to develop and improve their knowledge on this subject by using it.

The experience was to create a bank of questions to elaborate follow up questionnaires and evaluation tests for each lesson, so the student knows the degree of achievement of the course objectives and it suppose a feedback on the learning process.

In addition, the teaching process is evaluated and it is improved, from the students answer to items regarding a proposed survey. The results of the poll came out the utility of the software, the adequacy of the questions to the contents, the advantage of feedback to correct conceptual, procedure or interpretation errors. The students were grateful for practical problems related to their field.

This positive belief on the project motivates us to continue looking for real data mainly on health sciences and to incorporate new questions to our banks to enrich them and to bring statistic tools closer to our students; demystifying topics over them and showing that it is a useful science rounding us that must be known and properly applied.

## 2 WORK DESCRIPTION

Although the use of computer tools is widely extended nowadays, the practices on computer in the Statistic subject of the Physiotherapy Degree suppose a challenge for students since, in general, this is their first experience with statistical software.

Then, as it has been indicated above, the objective of our Learning Innovation Project was to elaborate guided practical besides bank of questions to be used in tests for evaluating the computer practices with Statgraphics in this subject. And, for this purpose, the ILIAS Virtual Learning Platform gives a suitable environment to develop these materials which can be used by students in any moment and place.

On the one hand, guided practices pretend showing and releasing the students to solve practical cases at hand by using the theoretical statistical concepts studied in the subject and using statistical software. The idea is to model the way a problem comes to a solution. On the other hand, evaluation and self-evaluation tests allow the students to assess their own performance while they have the opportunity to obtain feedback from their own answers.

Computer practices for the subject "Statistic" of the Physiotherapy Degree are structured in six

sessions of about 2.5 hours each:

- Session 1. Introduction to the use of Statgraphics
- Session 2. Descriptive analysis of data
- Session 3. Probability distributions
- Session 4. Parametric statistical inference on one variable
- Session 5. Parametric statistical inference on two variables
- Session 6. The linear regression model

So, one guided practical, a bank of questions and a self evaluation test have been created for every practice session.

The methodology followed in this project can be summarized in the following steps:

### 1. Collection of Materials.

An exhaustive search and selection of materials related to the resolution of statistic problems in the Health Sciences field has been carried out.

Moreover, during the first weeks of the semester, students filled out a survey prepared on purpose to get real data of different variables in the Physiotherapy field.

### 2. Design of Guided Practices.

One guided practice has been created for every practice session, with the aim of showing students the best way of solving different type of exercises by the application of the theoretical concepts studied in this part of the subject.

### 3. Elaboration of Banks of Questions in ILIAS.

For every practice session, a bank of questions has been created in the ILIAS Virtual Learning Platform with the answers to the exercises proposed in this practice. ILIAS platform has allowed us the use of different types of questions: multiple choice, numeric response, ordering, fill-in-the-blank, short answer or matching questions, among others.

### 4. Layout of Self-evaluation Tests in ILIAS.

From the above banks of questions, different self-evaluation tests have been performed including the different types of questions allowed by the ILIAS platform. The main aim of these tests is that students can self-evaluate the suitability of their results in the computer practices.

These tests provide a feedback for students because, once they have finished the test, they can see the score obtained and the correct solution for each question. Moreover, students can repeat every test in any moment until they get the desirable result.

Finally, an evaluation test, similar to the self-evaluation tests given for every computersession, was used in the final computer practices exam.

### 3 ANALYSIS OF RESULTS AND CONCLUSIONS

The aim of this section is to show our experience in the use of these materials in the subject "Statistics" of the Physiotherapy Degree during the last academic year 2011-2012.

During this academic year, the above described materials were used to evaluate the part of the assessment system corresponding to computer practices which supposes a 30% of the final mark of the student. With this methodology, the 70% of students joined in the subject "Statistics" passed the practices evaluation with a good mark. Unfortunately, there is not any historical data for comparison but it can be considered a satisfactory percentage, taking into account the difficulty that Statistical issues suppose for these students.

Furthermore, to evaluate the elaborated materials and their utility in the evaluation process, students were proposed to respond a survey created in the ILIAS platform with question related to the computer practices and their evaluation.

This survey was initially proposed to all students joined to this course, i.e., over a whole of 81 students, but it was voluntarily filled out by 47 of them. This fact supposes a participation percentage of about 50.6%.

The items of this survey were structured in three blocks related to:

1. the computer practices
2. the self-evaluation tests
3. the evaluation test for the computer practices exam

Students might value each item with a mark from 1 (completely disagree) to 4 (completely agree).

The best valued items, with modal value of 4, were:

- Computer practices fit with the theory.
- The used software is accessible, user-friendly, work environment, etc.
- Computer practices have helped me to understand the statistical concepts.
- The questions in self-evaluation tests are appropriated for the computer practice developed.
- The type of test is easy and comfortable to use from the ILIAS platform
- Questions in the evaluation test are adapted to the computer practices solved during the sessions and the self-evaluation tests.

On the other hand, the worst valued items, with a modal value of 2 were two specific questions:

- Clarity of some questions and lack of ambiguity.
- Data used in computer practices are of interest in the Physiotherapy field.

With respect to the first of these items we must say that although this answer can be motivated by the formulation of questions which motivate the statistical reasoning, we think that they should be revised in order to avoid any confusion.

On the other hand, the second issue highlights that the exhaustive seeking of examples in the Health Sciences environment has been insufficient and unsatisfactory for the interests of our students and a major effort should be done in this sense.

From students' opinion, our general evaluation of this experience is very positive. Moreover, we would like to emphasize the generality of the learning material presented here which can be used as a learning support in many other compatible subjects with basic statistics contents.

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