E-LEARNING IN THE TEACHING-LEARNING PROCESS AT POSTGRADUATE LEVEL: APPLICATION TO GEOMET SUBJECTS

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Abstract

This teaching innovation project arises from experience previously gained with other innovation projects encompassing several degrees with the aim of improving the academic performance of the students and the quality of teaching in several subjects of the Master's program in Geophysics and Meteorology (GEOMET) at the University of Granada (Spain). Among other novelties, through this project resources have been developed for students to carry out an online self-assessment of their knowledge regarding contents of the different subjects through the Moodle platform, checking the level of skills acquired. In addition, the project includes a system of exchange of teaching, electronic resources between teachers and students (guides of subjects, viewgraphs, practical documents, among others). This platform has increased the coordination between the lecturers who teach the subjects.

Keywords: e-learning, GEOMET, Moodle.

1 INTRODUCTION

As a consequence of the implementation of the European Higher Education Area (EHEA), in recent years many university innovation projects have focused on improving aspects of teaching at the undergraduate level. In contrast, improvement of postgraduate teaching has been postponed. However, the teaching excellence of Spanish universities lies in a postgraduate teaching of quality and the University of Granada (UGR) is committed to this.

The Master's program in Geophysics and Meteorology (GEOMET) at the University of Granada (Spain) is characterized as a multidisciplinary postgraduate program that welcomes students from different degrees and, therefore, with different levels of training and interests. In addition, it should be noted that in recent years the number of foreign students has increased substantially, specifically in the last two academic years with 30-35% of students coming from abroad. The diversity of the students led their lecturers to reconsider the teaching methods developed until now and to seek improvement actions. The present project, coinciding with the title of this communication, was designed based on the work previously developed in other projects at undergraduate level by members of this lecturer’s team, giving continuity to the teaching innovation, in a continuous process of improvement as a key to success in the learning process (e.g. [1]). The main objective of this project has been to improve the quality of the teaching of several postgraduate subjects of the GEOMET Master's program through the e-learning platform Moodle. To this end, different aspects have been covered, from the creation of specific self-assessment questions for each of the subjects involved, up to offering new resources to orient the student's active work, as well as to increase the internationalization of the University of Granada. In this sense, this project has allowed the students to have a set of resources favouring self-training and encouraging their autonomous work.
The present project is about innovation at the postgraduate level and was designed taking advantage of the work developed in previous projects and works (e.g. [2], [3], [4], [5], [6], [7]). All of these have been developed in previous academic years by members of this team of lecturers, giving continuity to teaching innovation, in a continuous process of improvement, as a key to success in teaching.

The general objective of this project was to improve the design and development of the teaching of several postgraduate subjects of the GEOMET Master's degree through the e-learning Moodle platform. For this purpose it was intended to:

1. create resources for the different subjects covered by this project, including guides for each topic, summaries and comments of the most appropriate bibliography to strengthen the contents. This is a relatively widespread practice in undergraduate education, but is quite poorly applied at the graduate level.

2. create on-line self-assessment questionnaires. Given the complexity of postgraduate subjects, this kind of resource is almost non-existent, which, paradoxically, proves to be extremely useful in the students' learning process.

3. create tables of symbols by thematic blocks in those subjects in which, due to their complexity and variety of topics, is necessary. This will be useful in the future professional development of students.

4. increase the internationalization of the University of Granada by offering these resources both in Spanish and English, in order to facilitate learning by foreign students.

These specific objectives perfectly fit 4 of the 6 objectives of the regulation of the teaching innovation project at UGR, which are listed below:

1. stimulate the development of innovative teaching strategies and strategies that favor teaching based on the active participation of university students

2. improve methodologies and teaching methods used in theoretical and practical classes, in a way that improves the overall training of students, their learning and their results

3. promote the creation and consolidation of teaching teams that collaborate to improve the learning of a certain group of students

4. promote the innovative use of the recruitment and services of the University of Granada

5. promote the dissemination to society of academic activity

6. promote and institutionalize good teaching practices and the improvement of teaching resources.

2 METHODOLOGY

The fundamental task of this project was the development of new teaching electronic resources that will support the student in the study of different subjects of the Master's degree in Geophysics and Meteorology of the University of Granada. In addition to a previous review of the existing contents of the Spanish resources of the subjects covering by the project, the activities carried out included the preparation of resources in English and implementation on the Moodle virtual platform.

In order for the student to also carry out a self-assessment process, self-assessment questionnaires were developed that allow him/her to interactively practice with answers to multiple-response tests, as well as in the formulation of concepts related to subjects. Before carrying out this project, these resources were practically non-existent, thus we consider this aspect essential in the project. The lecturers participating in the project were organized into working groups around the different subjects, developing the corresponding resources according to their expertise.

Specifically, the tasks performed for each subject were: review of the resources currently available; preparation of resources to support the subject (for each subject: guide, summary and comments on bibliography); creation of self-assessment questionnaire by lecture; implementation in Moodle; English translation of all the resources generated and implementation in Moodle; preparation of a survey for internal evaluation and external evaluation. The evaluations were carried out by a lecturer from the University of Granada (Spanish and English), two students from the University of Granada (Spanish and English) and three lecturers/researchers from prestigious international universities and research centers related to the master (only English). Table 1 shows the list of subjects and the timing.
Table 1. List of subjects involved in this project and timing.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Period of tasks</th>
<th>Period of evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmospheric dynamics (AtmDyn)</td>
<td>01/09/2015-15/02/2016</td>
<td>16/02/2016-28/02/2016</td>
</tr>
<tr>
<td>Atmospheric radiation (AtmRad)</td>
<td>01/10/2015-15/02/2016</td>
<td>16/02/2016-28/02/2016</td>
</tr>
<tr>
<td>Micrometeorology and microclimatology (Micro)</td>
<td>01/03/2016-15/07/2016</td>
<td>16/07/2016-31/07/2016</td>
</tr>
<tr>
<td>Instrumentation in geophysics and meteorology (Instrum)</td>
<td>01/03/2016-15/07/2016</td>
<td>16/07/2016-31/07/2016</td>
</tr>
<tr>
<td>Methods and techniques for observing atmospheric aerosols (AtmAer)</td>
<td>01/09/2016-15/01/2017</td>
<td>16/01/2017-31/01/2017</td>
</tr>
</tbody>
</table>

3 RESULTS

All the resources generated in this project for each of the subjects can be consulted on the platform http://atmosfera2.ugr.es/moodle once the administrator enrolls the user. Figure 1 shows the window of access to the platform, with the general list of available subjects. This platform includes the courses listed in Table 1 and also other subjects taught in different degrees at UGR (not included in the present project). Figure 2 shows, as an example, the virtual resources generated for the 1st lecture of the subject "Methods and techniques for observing atmospheric aerosols".

3.1 RESULTS

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![Moodle platform](image-url)
3.1 Results of the internal and external evaluation

As indicated in section 2, there have been internal and external evaluations of the resources generated in the project through surveys of each of the subjects covering all the generated items (guides, summaries, bibliography comments, self-assessment questionnaires) for each one of the lectures. On the one hand, the internal evaluation has been carried out by three national evaluators, being able to evaluate all the materials in both Spanish and English. On the other hand, the external evaluation has been carried out by three national evaluators who have been able to evaluate all materials in both Spanish and English and three foreign evaluators who have only evaluated the materials in English. All the evaluations were carried out in three stages, with a specific group of subjects being evaluated at each stage (stage I: AtmDyn and AtmRad, stage II: Micro and Instrumentation, stage III: AtmAer). The evaluated items were: (i) quality of the explaining slides, (ii) usefulness of the explanatory slides, (iii) quality of the lecture’s description, (iv) usefulness of the lecture’s description, (v) quality of the bibliography’s comments, (vi) usefulness of the bibliography’s comments, (vii) amount of self-assessment questions, and (viii) quality of self-assessment questions. Each item was evaluated on a scale of 0 (minimum) to 10 (maximum). The results of the internal and external evaluation are shown in Table 2.

The subjects AtmDyn, AtmRad and AtmAer obtained in general excellent evaluations (> 9.00) in its Spanish version. However, in the AtmRad subject, both the quality of the slides and the self-assessment issues should improve slightly to achieve the excellent grade. Similarly, the quality of AtmAer's comments should be slightly improved. The items in the Micro and Instrumentation subjects obtained a good grade (7.00-8.99), excepting the quality and comments on bibliography in the Micro subject and the number of self-assessment questions in Instrumentation, which need to be substantially improved (< 7.00).

In the English version the items of all subjects were generally slightly lower than in the Spanish version, except for the Micro subject where the English versions received a substantially higher score in some items, as a result of having an English-native lecturer. Thus, the subjects AtmDyn, AtmRad and AtmAer obtained in general a value close to the excellent in its English version. The quality of the
slides has to be improved slightly in these three subjects, as well as the usefulness of the slides in AtmRad, quality and usefulness of comments on bibliography in AtmRad and AtmAer. As in the Spanish version, the items in English in the Micro and Instrumentation subjects were mostly graded as good (7.00-8.99), except for the quality of the bibliography comments in Micro and the number of self-assessment questions in Instrumentation, which need to improve substantially (<7.00).

Table 2. Mean value (and standard deviation in brackets) of the assessments for each item of each subject. Each item is described in section 3.1. For each item the first row refers to the items in Spanish and the second (in bold) to the items in English.

<table>
<thead>
<tr>
<th>Item</th>
<th>Subject</th>
<th>AtmDyn</th>
<th>AtmRad</th>
<th>Micro</th>
<th>Instrum.</th>
<th>AtmAer</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td></td>
<td>9.40 (0.63)</td>
<td>8.85 (0.88)</td>
<td>7.58 (0.97)</td>
<td>9.00 (0.45)</td>
<td>9.21 (0.74)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8.93 (1.39)</td>
<td>8.33 (1.73)</td>
<td>8.40 (1.09)</td>
<td>8.36 (1.57)</td>
<td>8.93 (1.26)</td>
</tr>
<tr>
<td>ii</td>
<td></td>
<td>9.27 (0.59)</td>
<td>9.00 (0.92)</td>
<td>8.25 (0.99)</td>
<td>8.95 (0.59)</td>
<td>9.21 (0.70)</td>
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<tr>
<td></td>
<td></td>
<td>9.34 (0.72)</td>
<td>8.83 (1.14)</td>
<td>8.75 (0.98)</td>
<td>8.67 (1.32)</td>
<td>9.05 (0.88)</td>
</tr>
<tr>
<td>iii</td>
<td></td>
<td>9.07 (0.88)</td>
<td>9.14 (0.65)</td>
<td>-</td>
<td>-</td>
<td>9.24 (0.74)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.23 (0.73)</td>
<td>9.07 (0.81)</td>
<td>-</td>
<td>-</td>
<td>9.12 (1.17)</td>
</tr>
<tr>
<td>iv</td>
<td></td>
<td>9.20 (0.56)</td>
<td>9.38 (0.50)</td>
<td>-</td>
<td>-</td>
<td>9.10 (0.62)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.20 (0.76)</td>
<td>9.21 (0.65)</td>
<td>-</td>
<td>-</td>
<td>9.12 (1.11)</td>
</tr>
<tr>
<td>v</td>
<td></td>
<td>9.27 (0.46)</td>
<td>9.05 (0.59)</td>
<td>6.00 (1.10)</td>
<td>9.00 (1.73)</td>
<td>8.97 (1.00)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>9.20 (1.03)</td>
<td>8.62 (1.21)</td>
<td>6.95 (1.50)</td>
<td>8.75 (1.50)</td>
<td>8.38 (2.18)</td>
</tr>
<tr>
<td>vi</td>
<td></td>
<td>9.33 (0.49)</td>
<td>9.05 (0.59)</td>
<td>6.13 (1.36)</td>
<td>8.33 (1.53)</td>
<td>9.03 (0.72)</td>
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<tr>
<td></td>
<td></td>
<td>9.27 (0.87)</td>
<td>9.02 (0.78)</td>
<td>7.08 (1.81)</td>
<td>8.50 (1.73)</td>
<td>8.47 (2.13)</td>
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<td>vii</td>
<td></td>
<td>9.00 (0.87)</td>
<td>9.14 (0.73)</td>
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<td>6.78 (1.48)</td>
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<td>8.46 (1.27)</td>
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<td>9.27 (0.96)</td>
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<tr>
<td>viii</td>
<td></td>
<td>9.33 (0.71)</td>
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<td>9.47 (0.80)</td>
<td>9.12 (0.55)</td>
<td>8.77 (1.24)</td>
<td>7.58 (1.24)</td>
<td>9.13 (1.06)</td>
</tr>
</tbody>
</table>

3.2 Generated products
The products generated have been of two types. On the one hand, as indicated above, electronic resources have been generated for each of the project subjects that can be accessed by the enrolled students and lecturers at http://atmosfera2.ugr.es/moodle. It is intended that this material be enriched every academic year, especially the section of self-assessment questionnaires to create an extensive bank of questions. On the other hand, the present communication can be considered as a product of this teaching innovation project itself, leading to disseminate our experience about the didactic methodology followed in this project as well as the main results to bring the use of English to our students.

4 CONCLUSIONS
The group of lecturers participating in this project, as well as the evaluators from different areas, considers this experience as very positive and we believe that it will have a good impact on the teaching-learning process of our Master’s program in future courses. The resources generated will be under a continuous process of improvement in the next years. Those which have obtained a score below 7.00 will be discussed by the corresponding lecturers before the next academic year in order to decide new actions to take for their improvement.

At the time of this communication, the evaluation of the students’ learning for all project subjects has not been carried out. However, in those subjects taught where the material was fully prepared at the beginning of the corresponding academic year, the students have shown a good disposition and acceptance of the methodology. We expect to conduct a survey of students enrolled in all subjects covered by this project during the next academic year.
ACKNOWLEDGEMENTS
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