

RELEVANCE OF ENGLISH AS SECOND LANGUAGE WITHIN PROJECT BASED LEARNING IN THE NEW MECHANICAL ENGINEERING DEGREE FROM UNIVERSITY OF LA RIOJA

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Abstract

Second Language Acquisition is one relevant competence that lectures must emphasize in the future due to companies currently are demanding this specific competence. The article introduces a specific methodology carried out during last year to improve the Second Language as a student's generic competence. The aim was the project based learning homework included in the subject Materials Science in the second course of the new Mechanical Engineering Degree from University of La Rioja. At the same time, the scheme of the whole methodology advocated by European Space for Higher Education principles has been detailed in order to present our experience to other professors. They can take advantage of it and apply to their subjects to enhance them in terms of Second Language Acquisition. We also explain both successes and failures acquired during the development of this initiative.

Keywords: *Project Based Learning; Second Language Acquisition; European Space for Higher Education; generic competences; Mechanical Engineering Degree*

Resumen

La Adquisición de un Segundo Idioma es una competencia de gran relevancia que las lecciones universitarias deben enfatizar en el futuro debido a que las empresas en la actualidad están cada día demandando más esta competencia en los estudiantes. El artículo presenta una metodología específica llevada a cabo durante el último año para mejorar la Segunda Lengua como competencia genérica de los estudiantes. El objetivo es los trabajos mediante aprendizaje basado en proyectos desarrollados en la asignatura de Ciencia de los Materiales del segundo curso del nuevo Grado de Ingeniería Mecánica en la Universidad de La Rioja. Al mismo tiempo, se detalla el esquema general de la metodología completa inspirada en los principios del Espacio Europeo de Educación Superior, con el fin de presentar nuestra experiencia a otros profesores. Se explican también los fracasos y éxitos obtenidos durante el desarrollo de la iniciativa.

Palabras clave: *Aprendizaje basado en proyectos; Adquisición de una Segunda Lengua; Espacio Europeo de Educación Superior; competencias genéricas; Grado de Ingeniería Mecánica*

1. Introduction

The new educational model in Spanish University (ME, 2003) is based on the establishment of the European Credit Transfer System (ECTS). One critical phase of this process is the update of traditional homework to the new teaching-learning systems. The chosen way for the new Mechanical Engineering Degree (MED) at the University of La Rioja (UR) (ME, 2005) is the incorporation of more dynamic and active educational methodologies into its subjects. These methodologies are mainly developed for an improvement in the quality of knowledge and skills acquired by university students.

English language is currently the main scientific and engineering language. Most people related to international projects and research works use English language. Indeed, European countries have taken forward English language in Secondary School. In case of Spain, the university is evolving in different ways. Some universities are making a great effort to transform their campus in an international campus very suitable to foreign students. But others are not pushing to their professors for adapting subjects and even degrees to the a Second Language. But English is the universal language and Spaniards need it for getting better employments out of Spain. Business, international exchange and science are three main areas where the Second Language chosen can be a way for achieving better job expectations for students.

When professors are designing the new engineering degrees and their subjects, the competences currently demanded by companies must be taken into account. If we analysed different options available, we see that most valued competences in student's opinion are those really interesting for labour markets. According to many works (F.J. Fernández Polo and M.C. Varela, 2009) the generic competence of Second Language (L2), specially in English language, is one of the most important. Indeed, authors' findings indicate that English is playing a lesser role in Spanish universities than in other international institutions previously investigated. They demonstrate that the local language is still the default choice for most jobs and at the same time, that there is a localized but significant demand for other foreign languages as well. For this reason many professors are moving forward last years for including this competences in their lectures. This works shows an experience carried out to increase the quantity of teaching materials that students have to improve their competence in second language. All these works are involved in the same approach in the Second Language Acquisition (L2A).

As we said at the beginning of this Section, universities have the obligation to give a solution to the request of the companies. The most suitable way is adapting a high number of compulsory subjects to English language, but not only as a merely translation. The design of subjects must include exercises correctly fitted for studying English language. We are referring to grammatical lessons, vocabulary and even pronunciation exercises. Training these aspects while students learn their technical competences is one of the best opportunities that university can offer to them.

The article presents both an experience carried out by Materials Science subject, an Area of Knowledge inside the Mechanical Department (MD) from the UR and the summary of the methodology finally implemented. We think that this experience is very positive because the adaptation of a technical subject to the L2 is more difficult than in science or belles-arts. For this reason, we started adapting practices and workshops based on project based learning instead of classical lectures. The future of this initiative is currently unknown but concerning next steps, we are almost sure that lectures and training exercises will be in our agenda for the current year.

In summary, and taking into account the current tendency of adapting Secondary and Primary School to English as the L2, the authors of the article are compromised to achieve a high performance in the use of this methodology for enhancing competences of engineering

students from the UR. To fulfil these objectives we present the next procedure, the experiences and a final analysis in relation with the work done was supervised by the Engineering, Data Mining and Numerical Simulations research group (EDMANS).

The article has been organised in three parts. First, the importance of the use of a second language is explained giving details about other related works and successful experiences. Then, a methodology is introduced about how to prepare teaching materials for a generic subject and finally, an example concerning laboratory practices and workshop tasks is detailed for the Materials Science subject in the new Mechanical Engineering Degree from University of La Rioja.

2. Background and works related to Second Language competence

Nowadays, competences are becoming more relevant for better definition of students' future and for modelling their role in the labour market. Competences stand for a dynamic combination of knowledge, practice skills, abilities and finally deep understanding. There are many reasons for increasing students' employability and citizenship behaviour and many studies have been done to remark these aspects (R. Lacuesta et al., 2011). Working on this issue, the Tuning Project for competences proposed a total of thirty different ones that were classified into three main sets: interpersonal, instrumental and systemic (Bloom, 1957). We provide the list of instrumental competences in which our two involved in this study are included:

- GC-1. Capacity for understanding written information in a critical manner.
- GC-2. Capacity for organization and scheduling.
- GC-3. Oral communication in the native language.
- GC-4. Ability to communicate ideas in different contexts.
- GC-5. Capacity for understanding and interpreting a second language.
- GC-6. Written communication in the native language.
- GC-7. The knowledge of a second language.
- GC-8. Elementary computing skills.
- GC-9. Information management abilities.
- GC-10. Capacity for synthesis and for analysis.
- GC-11. Problem solving.

Second language is a kind of instrumental competence, which is having an instrumental function. The main issue of this competence is to provide students with means and methods allowing them to put knowledge into practice in their job environment. In this work, and for carrying out the present teaching research, we considered two of the generic competences specified in the Mechanical Engineering guide proposed by the Spanish National Agency for Evaluation and Accreditation (ANECA). Briefly, we remark principal characteristics of the two generic competences involved in this study: GC-5, the capacity for understanding and interpreting a second language; and GC-7, the knowledge of a second language.

Most of the research in new European Space for Higher Education (ESHE) is focussed towards specific knowledge and skills that is the basis for university degree programmes; but Tuning Project principles also acknowledge that there must be a balance between specialist and generic competences.

A revision carried out by B. VanPatten and J. Williams (2007) describes main theoretical approaches in L2A field. The most dominant theories prior to 1990 with an important impact today are two: Behaviourism and Krashen's Monitor Theory. But nowadays, many new approaches have been presented to explain the learning capacity accomplished using L2. Some theories hold that excellent L2A results come from the development of 3 stages: an initial step with bits of explicit knowledge gained; later the explicit knowledge turns into

behaviour through a smooth execution, and finally, behaviour turns into near-native proficiency through consistent practice. Other different theory assumes the same cognitive device for language learning as for any other kind of knowledge arguing that SLA emerges from the learner's ability to induce regularities from the form-meaning mappings encountered in the input according to their frequency.

We can find some practical studies concerning L2A in recent years. For example, R. Slabakova (2009) investigated the L2A of scalar implicatures based on a range of quantifiers ordered in terms of informational strength. It was concluded that scalar implicatures present no problem to Second Language learners, and that linguistic pragmatic principles are universal. In other studies, the interlanguage behaviour of the students of English was carried out by M-Y. Yu (2010) focusing on how they offer compliments in a second language.

From the ANECA guide the unique competence involved in this study is classified as instrumental. In all the work done, the necessity of future surveys were taken into account for measuring the future development of this specific competence on the following courses. However, we do not deal with these data on this article because we need to carry out more studies before start its analysis.

3. Methodology

Once the generic competence of Second Language in English has been outlined and some examples have been described, the next section summarized the steps for including the mentioned competence in the degree. It can also be seen the list of the main objectives. Afterwards, each subsection details contents or teaching tasks.

The project is divided in five main steps: task assignments, scheduling classes, selecting topics, delivering tasks and finally, joining tasks.

3.1. Step 1. Task assignments to professors

In our case, we found two subjects in which the methodology could be implemented inside the new Mechanical Engineering Degree. Both subjects are in the first semester on the second and the third year of the course. Because teaching experience was higher in Materials Science we preferred this one. The Materials Science subject has 6 ETCS credits distributed in lectures and practical classes including workshops on report writing. The total of ECTS credit points for practical classes is 3.5 ECTS credits.

The works considered within this subject are the following:

- Practices in materials testing laboratory (Materials Science subject)
- Practical cases or applied exercises in small groups (Materials Science subject)

It has to be noted that the technique presented in this articles can be also adapted to other similar subjects (e.g., Manufacturing or Structures and Elasticity). Further research should examine better a method to extend it. As per the schedule the second year of the new Mechanical Engineering Degree will start in the year 2012; first tests will be conducted in the first semester of 2012. In this case, the authors believe that is a right decision comparing the initial results in a collaborative study to get experience before we reach at first conclusions.

3.2. Step 2. Scheduling and organizing classes and student environment

The project has been divided into five practical classes based on project-based learning (PBL). Each practice takes two hours, so the module is comprised in total of ten hours of practices in person.

The scheduling and the organization of the student environment raised considerable amount of doubts to the working group. In the end it was decided that the viability of the project were to schedule the subject as a PBL using small groups of students.

The main issues followed by authors for organizing the subject can be summarized in four points.

The first issue is the organization of small groups of students. As much complex is the use of the L2A, as higher is the necessity of paying close attention to all students. In the same way, without an intense level of student participation in class, we can predict that students will not be able to take advantage of the subject.

The second issue is the possibility of allowing professors a first contact with these learning practices without a final evaluation during the first year. It is clear that not only students are facing the necessary adaptation to this new methodology, for this reason one important aspect is this challenge for the first time also be a new aspect for teachers. Our proposal is to ask for implementing this methodology without an initial evaluation, because if we detect many initial deficiencies during the course, professors should not being penalized for failed trials in its early stage.

The third issue is to promote the participation of all students in the course. This is a parameter that should always be considered in all studies. Previous experiences indicate that students have a great tendency to focus practical and based on PBL subjects as a learning method not so tough as compulsory subjects. This is a key factor for achieving good results in student evaluations because the specific objectives of the subjects will be achieved only with high student participation. One additional aspect is that the students can also improve other generic competences like GC-4 (ability to communicate ideas in different contexts).

The last issue covers the insertion of some flexibility in the program of the subject. Materials Science is a rigid and compulsory subject. For this reason, if some flexibility is not included in the course, it will not able to have great chances of success. This is also one of the principal obstacle that professors use to find when they try to carry out the same method. Otherwise, we believe it would have been impossible to meet the skills required in a matter of core or mandatory character, while training and assessment skills associated with learning a second language.

3.3. Step 3. Selecting the topics, sections and materials to adapt

Regarding this step, three different ways that have to be accomplished:

- A reduction of the initial teaching material for the subject in order to save some workload for developing the skills required in learning the Second Language.
- The use of own teaching material according with the learning technique and the Second Language selected.
- Determine tools and teaching materials required to support new topics involved and to enhance the assimilation of contents by student.

The main objective of the presented work is the third one, which responds faithfully to the fundamental objectives of the L2A principles.

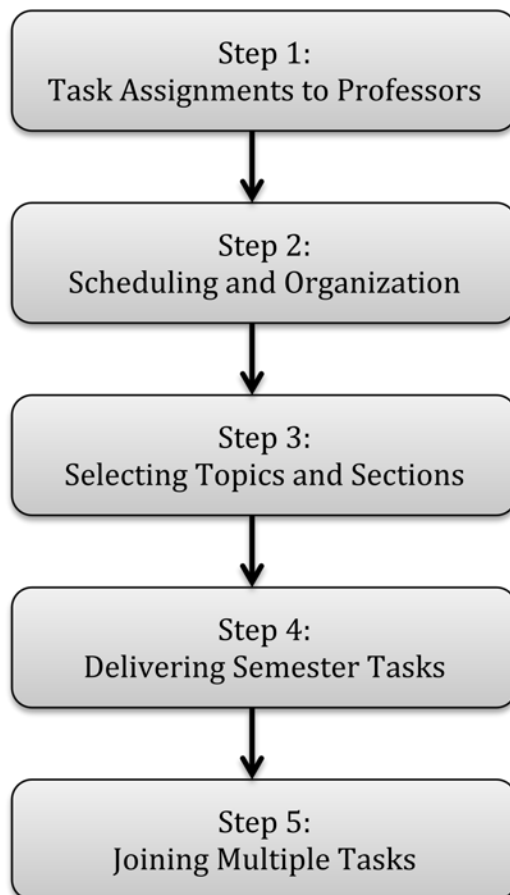
3.4. Step 4. Delivering tasks during semester

Now, the work is divided in specific task to assign a theme (or section) to each professor. It is mandatory that everyone involved try to solve all aspects related to the subject, even those problems with L2.

3.5. Step 5. Joining tasks in a unique way

Last step corresponds to the scheduling of several meeting with the objective of sharing the initial divided tasks. The professors should make an overall evaluation of the whole work when this is completed and finally modify those points not clear or misunderstanding.

Figure 1: Main scheme of the methodology proposed



4. Experiences in Materials Science approach base on PBL technique

The main issue of this teaching research was the development of the methodology explained in the previous Section 3. As a starting point, we think that its explanation can be enhanced through this article by a summary of several teaching experiences taking place during last year.

4.1. Participants in the Research

The first group of participants were two professors of EDMANS research group who are highly experienced in teaching these subjects (A. Sanz-García et al., 2011). They have worked in different areas of the Mechanical Department such as Thermal Engines, Project Management, Metallurgy & Materials Science or Manufacturing Area of Knowledge. They carried out this study but they did not have experience in using this new approach for both practical and research activities. They were 2 male professors, with two men in the same subject.

The second group of participants consisted of all undergraduate students. In new Degree we are expecting to have more than one hundred students ($N > 100$ approx.) enrolled in Materials Science course at the UR. Participants will include majority males ($N > 85$ approx.) and minority females ($N > 15$ approx.). But all students have to be selected to work.

Each professor, as explained above, had to perform the steps described in the previous Section 3 for each part of the subject, to schedule complete timetable and to prepare individually each chapter by translating in L2; while at the same time, they created the complementary documentation for the L2A (although some modifications were made after other members of the EDMANS groups made some appointments).

4.2. Main characteristics of the work

Based on the information presented this far, the main characteristics that define the work performed are as follows:

- A big student group that has to be divided in small groups.
- A compulsory subject with a high workload for the students.

Besides, we think, there are two key facts involved in this work:

- The necessities of encourage student participation in all activities.
- The development of educational materials needed to enhance the assimilation of contents to improve the quality of the teaching.

In addition to these two criteria, it is desirable that those students enrolled were studying a subject related to materials engineering or physics, or even better that they has already completed. Finally students must have at least a medium level of English to enrol in the course. These prerequisites are the minima to be certain that competences in SL are achieved. Therefore, as a good advice, we recommend to include a briefly summary concerning these issues in the guide of the subject.

4.3. Final approach of the subject

The main approach for designing the teaching materials of the course can be summarized in these five items:

- Starting point of the Materials Science agenda. Using an initial Spanish agenda, the first issue is to reduce its size. More hours in class time to integrate the specific skills about learning a L2 are necessary.
- Building the agenda in L2.
- Joining both agendas. Both subject's agendas, initial and L2, must being joint focussing in the development of both skills and competences.
- Preparing resulting agenda. Review and format the basic teaching materials for students.
- Adding a last Section corresponding to the content and language integrated learning (CLIL). Last, we Developed and included the exercises and other materials for supporting teaching classes.

5. Conclusions and conceptual ideas for future works

This work provides some conclusions and some special characteristics, which are described in this last Section.

One important idea is that professors must prevent for adapting or translating the most difficult issue of the agenda. For this reason, authors chose chapter 7 named "Composites and complex materials" and chapter 9 "Refractory and abrasive materials" and avoid of

including in the course. The mainly reason is that this topics have a greater conceptual difficulty for students. Just only using mother tongue to explain main concepts is already very complex; so in the opinion of the authors, more time and specific attention to the students need to be scheduled before they will be considered inside the work.

We though in a complementary proposal to join the L2 programmed activities. That is a final presentation, which is planned to carry out by each PBL group. The activity fits perfectly with the task because the students would be able to deal with four aspects of English language. In one hand they are reading and writing, and in the other hand they have to listen and speak.

Finally, there are two aspects that should be underlined. The first one is related to technical manuals and instructions of testing machines and even European standards. All of them are written in English language. Thus students are using the L2 without a great effort for teachers. They will also work with computer programs in English language, specially those concerning the statistical analysis of the testing results. This is the case of Engineering Equation Solver (EES), MATLAB© and R-project programs, which lack of Spanish version. We are really confident that students will become familiar with methodology a very short period of time, as well as managing software tools in another language, specially English, will require to them much less effort.

In conclusion, the adaptation process was, and we hope that will be for other professors, an enriching experience for every single professor in EDMANS research group, as well as for the Department as a whole.

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