

THE USE OF ICT AND THE FLIPPED LEARNING METHODOLOGY TO CLOSE THE SUBJECT'S PRACTICES TO THE LABOUR MARKET

Beatriz Urbano-López de Meneses¹, Xiomar A. Gómez-Barrios², Olegario Martínez-Morán², Marta Elena Sánchez-Morán², Antonio Morán², Fernando González-Andrés²

¹ *University of Valladolid (SPAIN)*

² *University of Leon (SPAIN)*

Abstract

The need to adapt the subject's practices, during the Degree and Master studies, to the competences and to the professional profile has already been demonstrated. The agenda for the Modernization of the Higher Education, published by the European Commission in 2014, remarks the need to adjust the curricula to the labour market, to promote the business spirit and to enforce the links between learning, research and enterprise in Higher Education. In Spain, the surveys of the Quality Education Office of public Universities, show that students, both Degree and Master, award a good valuation of the theoretical education although remark the need to improve the practical education at the University. The aim of this innovative education action is to approach the students to the labor market, by means of the practices of the subjects, using as tools, the ICT and the flipped learning methodology. The action includes four steps: The first step is to get in contact with the companies and to prepare real study cases of interest for the companies, in which the students will work during the course. Secondly, audiovisual material and other documents regarding the problems to be solved will be prepared and uploaded to the e-learning Moodle platform. In third place the students will approach the real cases proposed, and they will try to find different solutions for the problem, choosing the most adequate ICT to solve the case. By this moment, all the necessary theoretical concepts that the students need, will be arising, and using the technique of the flipped classroom they will be facilitated by the teacher. The teacher will set some deliverables to follow the students learning process by cooperative or tutorial, face-to-face or digital classrooms. Following with the flipped classroom technology, the fourth step will be the presentation of the solutions adopted by the students, including the ICT used, to the classroom, establishing a feedback from the students and the teacher, in order to consolidate the learning. Finally, the teacher will select some student's solutions to be presented to the companies. The diffusion will be at three levels, i) centre, ii) university and iii) inter-university. The results will be, i) the improvement of the practical teaching in Higher Education by the use of real labour market problems, ii) the enhancement of the use of ICT tools to solve them and iii) the improvement of the teaching-learning process.

Keywords: Engineering Higher Education, Practical Education, Flipped methodology.

1 INTRODUCTION

In 2014, the European Commission presented the Agenda for the Higher Education Modernization in order to align the modernization of the higher education with the objectives of the Europe Strategy 2020 (EACEA, 2014). The agenda established the priority to adjust the higher education studies to the labour market promoting the entrepreneurial spirit and enhancing the links between education, research and enterprise.

Additionally, the teaching and learning process proposed by the Bologna process, encourages an active participation of the student in the learning process. More relevant become these statements for engineering studies due to the need of its pragmatic approach. In these studies, the enterprise, the research and the universities must be collaborating closely.

Moreover, the Spanish National Agency for the Higher Education Quality (2016) advises to reinforce the actions to close the studies to the professional sectors in order to support continuously the students in the access to the labour market.

The public Universities in Spain harbour offices for the assessment and management of the quality of the academic system. The student's satisfaction report presented for such offices in general shows

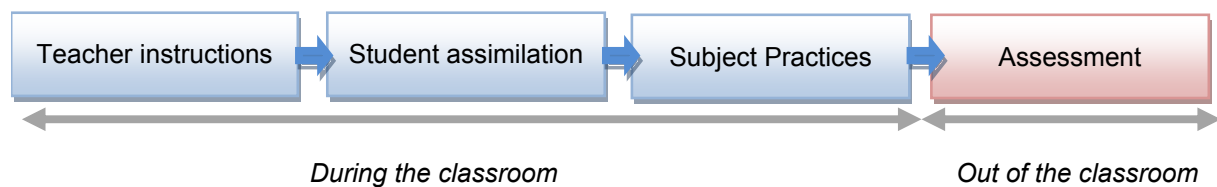
the need to improve the practical activities included in the face-to-face teaching hours, which in Spain are called “subject’s practices”, both at the Degree and the Master levels. The students remark the need to adapt the subject’s practices to the learning competences and to the professional profile. Despite the fact that the students appreciate the theoretical lessons, they declared that practices are improvable (Assessment and Quality Office, 2016).

1.1 Flipped learning

Flipped learning is a pedagogical strategy that reverses the traditional learning environment. The flipped classroom describes a reversal of traditional teaching where students gain first exposure to the topic by the practices, and then class time is used to do the harder work of assimilating the knowledge through strategies such as discussion or debates that take the students to the concepts (Brame, 2013) (Fig. 1).

“Flipping the classroom” has become a common word in education during the last years, driven in part by high profile publications in *The New York Times* (Fitzpatrick, 2012); *The Chronicle of Higher Education* (Berrett, 2012); and *Science* (Mazur, 2009).

Traditional classroom model



Flipped classroom model

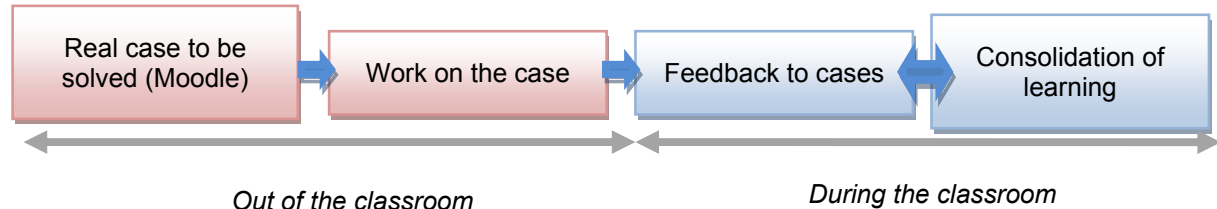


Fig. 1 Flipped classroom model versus traditional classroom model. Adapted to the case presented in this work, from <http://www.theflippedclassroom.es/what-is-innovacion-educativa/>

1.2 Innovation and Communication Technologies (ICT)

One of the most prominent characteristic of the present generation is their technology savviness and use of that technology in almost every aspect of their lives. The students spend on average of 33 hours per week on the internet (Kilian *et al.*, 2012), with 83% being engaged with online social networking sites (Zickuhr, 2010). Almost all the students in developed countries have a smart phone (Miller, 2014). It is estimated that it won't be long before one-third of the world population will engage in some shape or form with social media. Facebook is the number one global social media site followed by YouTube, QQ, WhatsApp, Qzone, Twitter, SinaWeibo, WeChat, Google+ and Instagram (Web empresa, 2015). Moreover, Facebook is the principal social media in America, Europe, Oceania, part of Asia and Africa, while Twitter is the principal social media in Japan (Web empresa, 2015).

The aim of the innovative teaching action presented is to close the engineering students to the labour market solving real cases affecting the companies of the sector, using the ICT with the flipped classroom methodology.

2 OBJECTIVES

The general aim of this innovation teaching project is to adapt the subject practices of engineering studies to the learning competences and to the professional profile using flipped classroom, by the resolution of real study cases with ICT.

The specific aims are:

- 1 To close the students to the labour market through the subject practices.
- 2 To solve real cases from enterprises, in order to bring the subject concepts to the students, according to the flipped classroom methodology.
- 3 To facilitate the interaction between the students and enterprises giving solutions to problems by the use of ICTs.

3 METHODOLOGY

The methodology chosen for the implementation of this innovative teaching action was the flipped classroom plus ICTs, according to the following stages (Fig. 2)

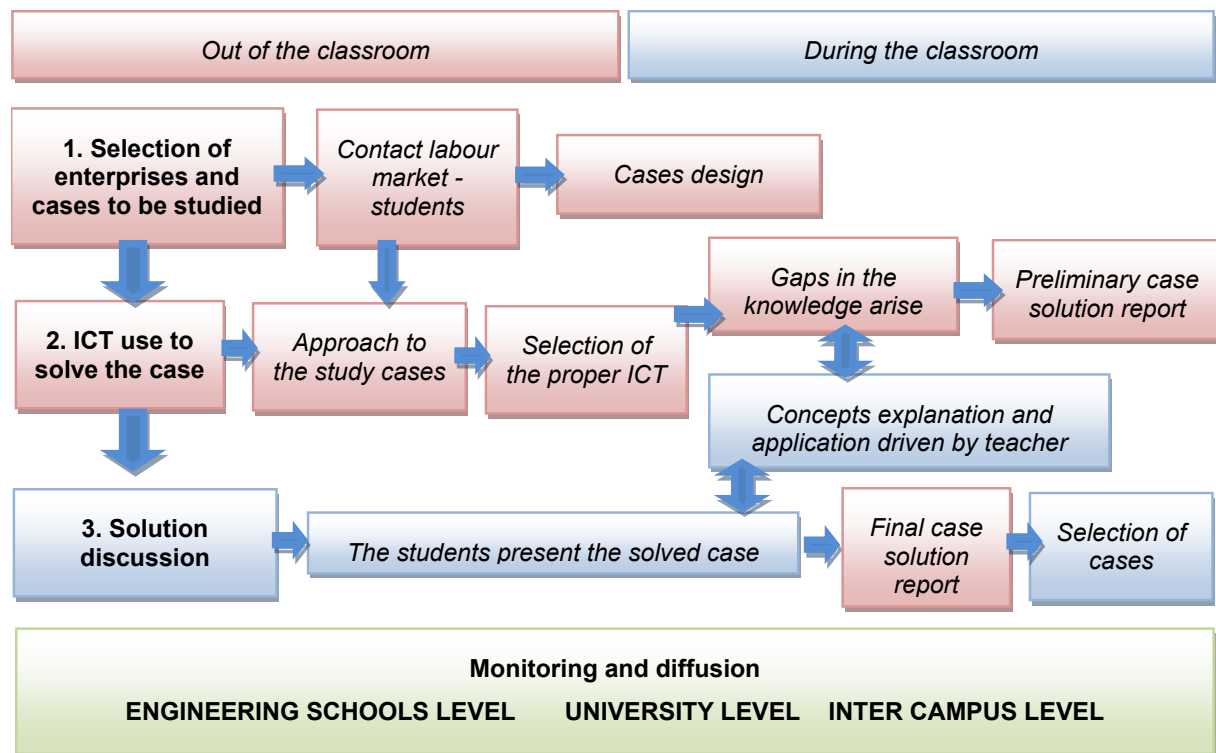


Fig. 2 Description of the methodology for an ICT practices in flipped classroom.

3.1 Selection of study enterprises and cases

3.1.1 Putting in contact the labour market and the students

The teacher will introduce or invite a representative from companies of the sector, as for example trade unions, professional associations or and enterprise, who will approach the students to the problems of the specific business sector. This presentation can be face-to-face or alternatively recorded and loaded to the e-learning Moodle platform. The students will have their first contact with the business sector, and the will have an image of the difficulties to be solved in the professional sector.

In order to choose the companies for this pilot experience, the students are invited to contact with companies of their interest, in order to know their needs or problems, and to prepare by themselves a case of their own interest to be solved during the course. Moreover, the teachers involved can also

provide specific companies to be studied, from their own collaborative agreement in research or consultancy (i.e. 11 enterprise-university agreements signed in 2015).

3.1.2 Cases design

Teachers in collaboration with the company representatives, will elaborate the cases that will be solved by students (using ICTs) during the course. The teacher will write the rules to solve the cases and, also will fix the deliverables to be presented by the students. Rules will be uploaded to the e-learning Moodle platform.

3.2 Technology incorporation

3.2.1 Approach to the study cases

The students will study the case to be solved at the beginning of the course. The practices will precede the theoretical concepts, following a “flipped classroom” technique. The first step of the teaching-learning process will be to identify the problems that the companies of the sector need to solve. The class time will be used to give conceptual and theoretical skills needed to solve the proposed study cases. Teacher will actively guide students in order to apply the concepts to create the subject contents.

3.2.2 Selection of the proper ICT

The student selects the proper ICT to solve the case proposed. Some ICTs that could be used are: i) to record the evolution of an experiment, ii) an on-line survey to the stakeholders for a given market, iii) to develop a software to help in decisions making; iv) to test innovative products throughout social media, etc.

At this point the student will collect information from bibliography, companies, social media and teachers that will help them to solve the study case. Special attention will be given to the use of social media. The teacher must direct the interaction of the students with the companies in order to limit the company participation in this activity, within reasonable limits for the two parts.

3.2.3 Concepts explanation and application driven by the teacher

After the student has approached the study case, the teacher will explain the concepts related to the study cases and the subject. The concepts will help the student to solve the study case.

3.2.4 Preliminary report of the solution to the case

The student will write a proposed solution for the study case. Special attention will be given to the use of ICTs to solve the problem. The report must explain the decisions taken and the possible alternatives including the advantages and disadvantages.

3.3 Solution discussion

3.3.1 Presentation of the study case by the students

The student will present the study case and the solution chosen, including an ICT, to the rest of the students. The rest of the students will ask about alternatives and possible solutions for the problem. Then, a discussion about the problem and solutions will start. At this point, it will be established a feedback between the students which present the case in the one hand, and the rest of the students driven by the teacher in the other. As a consequence more concepts, of a higher knowledge level, will be introduced in the system.

3.3.2 Selection of study cases

The teacher can select some of the solutions given by the students, to be presented to the companies, which can use the information obtained to improve their activity. This step gives the chance to present the students’ abilities to the employers. This reinforces the link between university, companies and research.

3.4 Monitoring and diffusion

3.4.1 Engineering schools level

The teachers involved will assess the learning process and will write down the strengths and lessons learned. The teachers will share the experience with the rest of the colleagues of the teaching innovation group. The teaching innovation group will discuss about the need to transfer the results to other subjects and studies, and will elaborate a “manual of good practices” for this application of this methodology. The conclusions will be shared with the teaching staff at the Engineering Schools.

3.4.2 University level

The experience will be presented in the teaching innovation forums at the University, in order to spread the results at the University level. The methodology and results will be published in the institutional webpage for the persula of the University community.

3.4.3 Inter universities level

The participation at international forums will disseminate the methodology and results contributing to flipped lessons and to close the students to the labour market through the subject practices.

4 RESULTS

The methodology is implemented in six subjects, i) Crop Production, ii) Agribusiness Marketing, iii) Bioenergy, iv) Biotechnological processes, v) Biofuels and vi) Cropping Systems of Engineering Studies.

Table 1 presents the indicators and evidences of results according the objectives of the project.

Table 1. Indicators, evidences of the results according to the initial objectives of the innovation teaching project.

Results	Indicators	Evidences
To close the students to the labour market through the subject practices.	Real cases of the companies will be designed for the students	Publication of the case in Moodle platform
To solve real cases from enterprises, in order to bring the subject concepts to the students, according to the flipped classroom methodology	The assessment and solution of the case drives the student to the concepts of the subject	Report of the students about the case analyzed
Link the students to the enterprises, presenting solutions for real problems	A selected sample of students solutions are presented to the involved enterprises	The webpage of the University will present the solutions selected (providing that the company authorizes such publication)

The results show motivated students, in some cases due to their participation in choosing the topics for their practices, and for those who did not choose the topic, because of the stimulant effect of merging the academic and the labor worlds, observing the applicability of the subject practices to the real professional sector. It is concluded that one of the results is the students motivation that could drive to a higher students performance.

It was concluded that the implementation of the flipped methodology leads to a better monitoring and assessment of the subject practices. Starting the course by the practices, allows the teachers a better follow-up of the learning progress. The flipped classroom causes a higher implication of the students at the teaching-learning process. The students are driven to the concepts through the real study cases. In this sense, it is proven that the methodology reinforces the Bologna process.

The use of ICTs, which are familiar technologies for the students, helps them to face the problems of the engineering, and to solve them. It is concluded that the students are highly involved at the technological innovation and communication means.

The flipped methodology proposed promotes a collaborative and autonomous learning. The autonomous learning precedes the collaborative learning that induces the student creativity. The group presentations drive the students to the collaborative learning with the feedback of the rest of the students. Finally, the teacher contribution to the concepts of the subject facilitates to complete an integral teaching learning process.

The interaction between the teachers involved in the teaching innovation group, helped to improve the methodology. It would be interesting to include a feedback from the rest of the academic community at the international level, not only from the seminars at the national or international level, but also by a suggestions mailbox in the webpage where the action is presented.

It can be concluded that the teaching innovation project results are, i) the improvement of the practical teaching in Higher Education by the use of real cases from companies, ii) the enhancement of the use of ICT tools to solve real cases and iii) the improvement of the teaching-learning process by the application of the concepts to real problems of the engineering sector.

5 CONCLUSIONS

The students have the opportunity of actively participate in the process of design their own subject practices giving their opinion and showing their interest in the professional sector. As the students can choose the topic or enterprise in which they will work during the course, they become a part of the learning process since its design.

The practices will precede the theoretical concepts, following a “flipped classroom”. The flipped methodology promotes a collaborative and autonomous student learning. The flipped classroom reinforces the teaching-learning process. The subject practices drive the students to the theoretical concepts of the course. The students will learn the concepts by its application to real cases.

The students are highly involved at the technological innovation and communication means. The use of ICTs in the teaching-learning process motivates the students. The students learn how to solve real study cases by the application of ICT.

There is a feedback between students regarding the solutions proposed to the cases, which reinforces the teaching-learning process. The students will experience how their colleagues ask about possible different solutions or alternatives to the cases analysed, and they will need to analyse and consider different viewpoints. The interaction between students is an essential part of the flipped methodology.

The subject practices in the professional sector enhances the motivation of the students.

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