IMPROVING ACTIVITIES TO DEVELOP SOFT SKILLS USING FLIPPED TEACHING IN HIGHER EDUCATION

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Abstract

Flipped Teaching is a methodology that enables students to be more active and self-sufficient in their learning process, since it overthrows the classical teacher-student responsibilities assigned within it, improving skills related to planning and autonomy in students. Moreover, in higher education, soft skills have to be developed during this learning process, since graduated students, which are about to enter in the working world, must be properly trained. In this regard, university professors have to provide students with good materials and efficient activities covering both aspects.

At the Universitat Politècnica de València a group of 4 professors has been working in active methodologies and flipped teaching during the past 3 years, a period in which several experiences have been conducted. This paper summarizes a set of lessons learnt about the link that most popular face-to-face activities have with the acquisition of soft skills, and proposes some new actions aimed at improving the type of training activities carried out during the educational practice in the frame of flipped teaching.

Based on our experience, we highlight some of the common failures and weak points in diverse teaching subjects like Computer Science, Telecommunications, Linguistics, Agricultural Science and Physics, and soft skills such as comprehension and integration, critical thinking and long-life learning, among others.

The discussion and results are based on a bank of surveys in which students assess the validity of the educational practice and the influence of these practices on the development and acquisition of these soft skills.

Keywords: Soft Skills, Flipped Teaching, Blended learning, assessment

1. INTRODUCTION

Higher education is renewing continuously in order to offer graduated students the learning outcomes and training demanded by society. In this regard, professors at university look for new learning approaches, which improve the variety and quality of the activities leading to get students engaged to their studies [1].

These strategies are supported by technology and blended learning which are widely used in high education, sometimes by flipping the classes, placing lectures online and using face-to-face time to create conceptual understanding, cognitive skills and soft skills [2,[3].

Flipped classroom (FC) applied to several disciplines appears to be a good methodology for increasing the learning outcomes as it is based on active and collaborative learning which are very useful in problem solving and practice [4]. The best practice of flipped classroom considers not only the creation of digital materials to be watched online before the face-to-face session, but the design of assignments which immerse students into collaborative situations [5]-[7].

Soft skills (SS) emerged as a response to society's demand of having workers who are flexible to changes and ready to be learning all their professional life. These soft skills are transversal to all courses of the degree and they have to be put in practice and be assessed along the degree. These soft skills should be developed through activities and practices guided by a professor, in which case the FC may play an important role [8].

This paper focuses on different experiences in which the FC was applied during several academic years, with different approaches, in order to get students exposed to situations in which soft skills are needed to solve problems and real cases. A special emphasis is made in the class activities which can help

improve the learning of these skills. In particular, this work is focused on the soft skills defined for the degrees at the Universitat Politècnica de València[1].

2. METHODOLOGY

In this section, we are presenting the class activities implemented to improve the SS learning within different subjects and different SS.

2.1. Soft Skill: Understanding and Integration

Understanding and Integration is a soft skill developed and assessed in the first course of Physics in the Biotechnology degree. Practice and development of this soft skill came out in activities proposed in 5 labs (10 sessions), that are mainly focused on measuring indirect physical quantities. In this regard, students must understand not only the measurement procedures but also physical models in which they are based on. Students are due to watch a video before working in pairs in the lab. During the lab session, students work on the physical model and after that, as a homework, they have to answer a training questionnaire in order to check the degree of their comprehension.

In the 2016-17 academic year, a problem regarding to the physical model of each lab was introduced as a novelty. Students were requested to sort out 5 problems (one for each lab) at home to widen their comprehension and deepen into the connection between theory and practice. These problems count for the assessment of lab activity, and therefore students were forced to do them. The assessment done during this academic year took into consideration both questionnaires and problems with the same weight. Despite students were allowed to use the lab book and the final grades were fine, the students were upset due to the high amount of work and study done at home in this activity [8].

Therefore, in the 2017-18 academic year, we removed the problems as a homework activity, and a set of four open questions were proposed, as an example, in one of the class sessions. These questions considered the recommendations given by the Universitat Politècnica de València for assessing these soft skills. After this sort of training, the correct answers of the questions were available, as well as the different levels of achievement. Students were encouraged to review their lab reports and to make a reflection on them based on the type of questions proposed in one of the labs. The assessment was composed of two parts: part A with a questionnaire similar to the training one, and part B with four open questions designed to assess the main learning outcomes derived from this SS: identification of ideas (conceptual map), understandable explanation, good interpretation of concepts, and integration of different ideas to get accurate results (problem). Students were allowed to use the lab book.

2.2. Soft Skill: Teamwork and leadership

In the last three years a 20-hour module has been taught aimed at university professors to develop competencies in teamwork through the use of online platforms. To work this soft skill the students (in this case professors) were divided into teams of no more than 7 people and were given a document from which they have to prepare as team a slide-set presentation. They were offered different alternatives to work on that presentation, but always using a PowerPoint document in Office 365 that they will have to edit together in an online session, all at once. Communication during that session can be done through Skype, Google Hangouts, Adobe Connect, or similar, but allowing them to talk to each other, without being physically in the same place.

The result of this totally online and synchronous experience of cooperative work is then exposed in a face-to-face class, where not only content is talked about, but also the students one's experience, seeing how they have been able to work as a team without being physically at the same place.

2.3. Soft Skill: Specific Tools

In the Master's Degree in Parallel and Distributed Computing, the subject Public Cloud Infrastructures (ICP) is a control point of the soft skill Specific Tools, which refers to the use of the tools and technologies specific to the professional activities of the graduates, in this case Cloud architects. The subject addresses different Cloud Computing platforms but focuses on Amazon Web Services (AWS) to deploy application architectures that also involve data management on the Cloud. Students must integrate different AWS services to solve real computational and data management problems. To develop this

[1] http://www.upv.es/contenidos/COMPTRAN/index-en.html

skill, students use a preconfigured working environment that has the required software tools to perform hands-on activities as well as the access credentials required to use AWS services.

In Moltó et al. (2017), an experience was described in which the students start the lab activities at any time (even outside the classroom) so that they dedicate the classroom session not only to progress with the lab sessions but also to solve the pending doubts from the realization of the hands-on labs. Indeed, offering a remote lab allows practical activities to be carried out at any time and not just on the assigned schedule. Starting from the academic year 2017/2018, we have developed a system called CloudTrail-Tracker[2] that tracks the activity of the users on AWS. The system logs all the relevant actions performed by the students with each AWS service. This way, the professor can obtain a report anytime about the degree of completion of each lab session for each student. For this, we consider a lab session as a sequence of events or steps that the student has to follow. By tracking the realization of those steps, the professor can determine if a student is on the right track doing the lab sessions or, otherwise, the student requires further support from the professor.

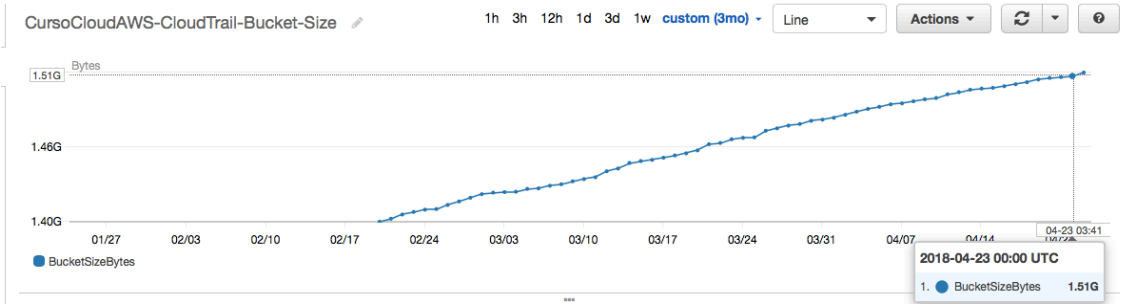

Figure 1. Size evolution of the data gathered from students for the lab sessions.

Fig. 1 shows the incremental evolution of the data gathered from students concerning the realization of the lab sessions starting from July 2013 up to now. The dataset consists of each and every operation performed by each student with every AWS service together with a timestamp (when the operation was performed) and further additional information. This involves more than 1000 students across 5 academic years, three different Master's Degree on which the same platform is employed (Master's Degree in Parallel and Distributed Computing, Master's Degree in Information Management, Master's in Big Data Analytics) and an online course on Cloud Computing with Amazon Web Services which is offered worldwide.

This data is processed in order to obtain the relevant information to a specific student on a given time frame (since the start of the subject until its end). A sample information obtained in such report is shown:

-- BEGIN REPORT FOR alucloud36 (TIMESTAMPED EVENTS FROM 2018-02-19) ---

ConsoleLogin Tue Mar 27 13:00:59 CEST 2018

ConsoleLogin Tue Mar 20 17:41:23 CET 2018

DeleteLogGroup Tue Mar 13 16:12:20 CET 2018

DeleteBucket Tue Mar 13 16:12:10 CET 2018

DeleteStream Tue Mar 13 16:12:08 CET 2018

2.4. Ethic- environmental responsibility/innovation and entrepreneurship/ practical thinking

Those are three very different soft skills that are worked and assessed in the lectures of "IP rights and commercial plant material management" within the master in Plant Breeding. The course deals with the application of laws and regulations and it used to be very harsh and theoretical course. In the 2016-17 academic year we started to use FC as a class methodology, including videos which the students watched at home for the most theoretical questions and using more time of the class to work on the students proposed projects. The results of this methodology was very successful [8]. However, to improve the learning outcome in terms of SS in the 2018-19 academic year new activities such as

[2] CloudTrail-Tracker: https://github.com/grycap/cloudtrail-tracker

debates, real law cases analysis, etc. were introduced. The idea was to use the class time to put together ideas, clarify terms and give the opportunity to students to face to real cases.

At the beginning of each class a simple test was perform to check if the students have done the previous activity at home (videos, reading etc) and then at the end of the term the students were asked about their learning process. The assessment of this soft skill was performed by a rubric over their projects and presentations.

3. RESULTS

3.1. Soft Skill: Understanding and Integration

The results of the methodology used in 2017-18 in comparison with 2016-17 show that the acquisition of the SS was more evenly distributed among students (Fig. 2). Fewer students obtained A grade in 17/18 than in course 16-17.

At this point, we may wonder which methodology is the best. The first because of the high percentage of A grades or the second because it follows the recommended guide and it seems to be a normal distribution.

In our opinion, the first methodology forces students to study the physical basis of each lab in more detailed way at home, but when they took the exam, they just repeat the same problem but with different data, so it might be hiding the actual acquired skills.

The second methodology focuses on the analysis of concepts, order of ideas, and description of processes and review the comprehension of physical models in class. The open questions seem to be more representative of the achieved level of the soft skills.

Additionally, students considered this system less stressful and more educational. Next academic year we will prepare more materials of this type to put them in practice not only in one single lab session but also in many other lab sessions.

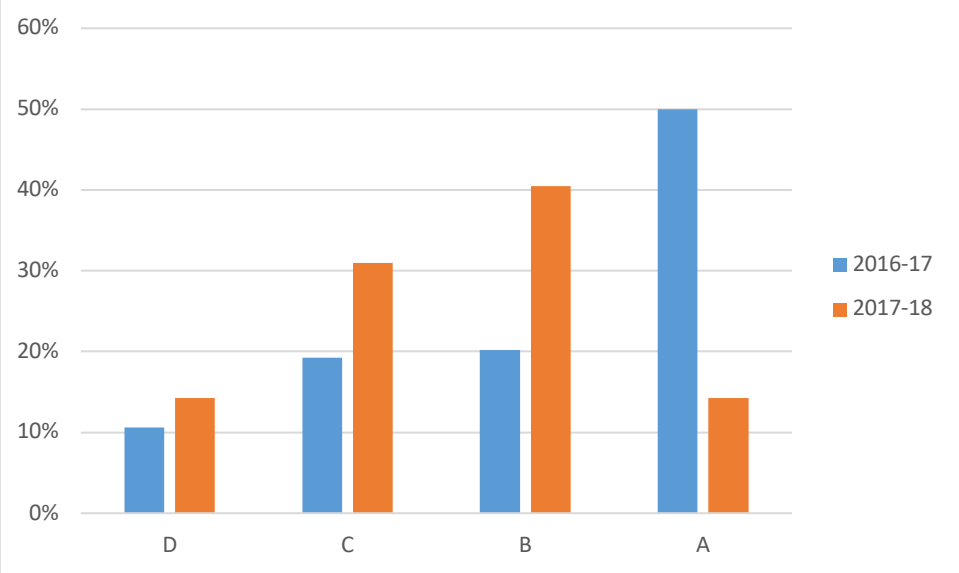

Figure 2. Frequency histogram for the grades of Understanding and Integration obtained by students of 1st course of Physics in two different academic years. Note that A refers to the best mark.

3.2. Soft Skill: Teamwork and leadership

Teamwork involves creating and developing a climate of mutual trust between the components that allows for working in a responsible and cooperative manner. The most appropriate term to describe this situation is sharing: share knowledge, commitment and responsibility. It involves the distribution of tasks and roles and respect for the rules established by and for the group.

The students are never prepared to face this situation, and there are many cases of success and failure in the preparation of this work. In this way, class time is used not so much to expose what has been

learned, which is irrelevant, but rather to perform the meta-learning of the experience. Thus, they can learn the need to designate a leader, the problems derived from the lack of prior coordination and other issues.

The use of FC, and especially the migration from the master class to the preparatory work of the student at home, allows the classroom to be used to develop, together with the students, activities that facilitate the experience of effective teamwork.

A very rewarding experience is to combine the use of new technologies with teamwork. For this, what has proven very effective is to use collaborative work platforms, such as Google Docs or Office 365, so that the same working document can be shared and edited at the same time by team members.

And, most importantly, students learn the great effectiveness of teamwork. They realize that in just 30 minutes they can prepare a complex presentation on a topic, and also feel that everyone can work in parallel efficiently.

In the surveys conducted on the session it has been collected, without exception, a total satisfaction with the experience. In addition, the impact on students is key, as they become evangelists of this way of working and will soon begin to incorporate it into their normal routines of collaborative work.

3.3. Soft Skill: Specific Tools

At the moment, the professor is generating the reports mentioned in methodology by means of client-side tools. However, we plan to further exploit these data in two areas. First of all, to proactively track the evolution of the student and automatically determine her progress in the subject. Second, to better adjust the estimated allocated for each lab session. This way, students can better plan the start of each lab session when they have enough free time ahead to carry out the activities, since they involve the allocation of resources in a public Cloud provider that need to be terminated when no longer used. This will also foster the “Time Management” soft skill for students.

The usage of non-intrusive techniques to gather evidences of the work carried out by the student out of which the professor can obtain automated reports is a great benefit both for students and professors. Indeed, students do not need to submit a periodic report on the activities fulfilled, which may be time consuming, and the professors do not need to check that document. Instead, automated verification of the activities performed by the users appears to be a useful approach to check the “Specific Tools” soft skills, especially for computer science subjects on which automation can be achieved by means of software tools.

3.4. Ethic- environmental responsibility/ innovation and entrepreneurship/ practical thinking

During the second year of implementation of FC for these SS, we tried to use the class time to perform high quality and participative activities instead of magister classes. This means that the appropriate rhythm of the class relays on the previous documentation work of the students: watch the videos, read the indicated readings etc. In this respect, this methodology is risky if the students do not perform their duties. As an example, it happens in one session that none of the students have watched the previous explanatory video and therefore it was impossible to give the class as it was planned.

The results in terms of satisfaction expressed by the students in the questionnaire about their learning were not significantly different from those of the course 16/17. In terms of the scores of the students for the evaluated SS they were slightly higher in 16/17 but maybe is due to the year effect. Nevertheless, we received were good feedback from the students who were very enthusiastic on the way of integrating the most theoretical knowledge with SS competence acquisition.

4. CONCLUSIONS

Teaching is always challenging and teaching soft skill is not easy at all, specially to design appropriate activities and to develop accurate ways of evaluating them. The flipped classroom methodology and the use of Information and Communication Technologies (ICT) offer a myriad of different possibilities to adapt our teaching to the students learning goals. Through our experience we can remark the following points:

- The activities to work and evaluate the SS must not be overloading for the students. If the work becomes excessive, the student loses motivation and goes to the classroom without having done the previous work, so that all the effectiveness of these techniques is lost.
- In addition, a good fit between the activity performed and the learning outcome improve the accuracy of the scores. The teacher cannot lose sight of the final objective of the activity and focus on the dynamism or level of fun of the work done. Each objective will have an adequate technique, and it is the professor's function to be creative and surprise students with different work schemes.
- It is important to provide the student with the necessary knowledge to make their individual work as efficient as possible. It is not enough to define the task, it is also necessary to accompany the student in the resolution of it.
- Any group work can be done online. Even the most specific tasks that may need contact can be carried out provided that the appropriate ICT that are used to facilitate the most possible human-like interaction.
- The professor has to be prepared to improvise in face-to-face sessions. It is very common to lose control over how the class evolves, as students will introduce much more variability. Therefore, it is convenient to have elements ready to modify the session according to the group's learning needs.

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