

FLIPPED LEARNING APPLIED TO MATERIALS SCIENCE

A. Páez-Pavón, J. A. Argüello

Universidad Europea de Madrid, Tajo s/n, Villaviciosa de Odón, 28670 Madrid
alicia.paez@universidadeuropea.es

Abstract

Educational innovation is becoming very trendy nowadays due to digital technology arise. This innovation brings dozens of new tools and educational systems. Among others, flipped-classroom is a promising educational innovation that can improve the motivation, the degree of retention and the grades of students. Here we present an example of flipped-classroom applied to materials science and the survey of students after the experience. We noticed that with flipping the class students improved the retention degree and were highly motivated. In general, it was a positive experience and students would like to have more classes in the flipped way.

Keywords: Flipped-classroom, material science, educational innovation.

1. INTRODUCTION

Educational innovation could be the solution of a various problems founded in educational system in Spain, such as the lack of effort and motivation of the students, absenteeism, insufficient level of knowledge in basic subjects, etc. At the same time, educational innovation could cover the recent demand of the 21th century student's skills as flexible thinking, communicating and collaborating.

With the irruption of new technologies, educational innovation has a vast range of tools to develop and transform educational systems. On this way, digital technology could facilitate [1]:

- Innovative pedagogic models.
- Real-time assessment.
- Remote or virtual online laboratories.
- Flexible access to experiential learning.
- International collaborations.
- Real-time formative assessment and skills-based assessments.
- Enable the active participation of more students in classroom discussions.
- Massive open online courses.

Also, digital technologies could provide a low-cost learning, enhance student's creativity and imagination and problem-solving skills, as well as a real-time students monitor for teachers so

teachers could change their syllabus and adjust to the different classes.

New technologies applied to the classroom is thus becoming essential for nowadays students. This is not only because new technology is evolving their lives, also because many companies are allowing employees to work from their homes.

According to UNICEF, the educational innovation is not just the use of new technologies it is also the quality and equity of learning opportunities and the ability of solving real problems.

Blended learning implies online courses and face-to-face courses and is taking hold as never before due to: free university courses, MOOCs (Massive Open Online Courses), students that are working while studying, international students, etc. Consequently, flipped-classroom is a technique that could fit on blended learning. Flipped-classroom means that events that have traditionally taken place inside the classroom now take place outside the classroom and vice versa [2]. The aim of a flipped-classroom is shifting from teaching to learning, to do so it is being used mostly a recorded video which is uploaded online in order to be available for the students, then the contents of the video are discussing in the face-to-face classroom so then students are able to utilize the time in class to work through problems, advanced concepts, and engage in collaborative learning [3]–

[5]. Also, instead of the video could be used different resources for the students such as a power point, eBook, textbook, recorded audio, web site, etc. Therefore, the students have to prepare the content before the class. To ensure that is happening, teacher could make a short assessment during the class.

There is no a single model for flipped-classroom but core features include: content in advance, educator awareness of students understanding and higher order-learning during class time [6].

2. EXPERIMENTAL PROCEDURE

In this study, a flipped classroom was performed in order to evaluate the response of the students to this new learning methodology. The flipped classroom was performed to students enrolled in Industrial Engineering grade and Materials Science subject. The topic explained to the students was the different types of fracture and fatigue in metallic materials. To perform the activity, the students viewed a video with an explicative recorded audio of 4:34 minutes of duration. The video was recorded using Microsoft PowerPoint tools, and it was uploaded on YouTube. It was available the days before the face-to-face class. The day of the face-to-face class, the students carried out an activity consisted of drawing a fatigue curve (curve S-N) from data provided in the statement. In addition, the students were asked questions related to the concepts explained in the video, in order to assess whether they had understood the main concepts of the proposed topic.

Once the practical activity was completed, a satisfaction survey was conducted, in order to know the student's opinion regarding this activity.

Below are the questions asked to the students:

1. Did you find any problem accessing the resource online?
 - a. Yes (Could you tell us what?)
 - b. No
2. Did you feel motivated with the experience?
 - a. Yes
 - b. No
 - c. Indifferent
3. Would you like to have more flipped classrooms during the course?
 - a. Yes
 - b. No

- c. Indifferent
4. When did you watch the video?
 - a. The day before the face-to-face class.
 - b. The day of the face-to-face class.
 - c. I did not watch it.
5. Have you asked yourself more questions with this type of teaching than with the traditional format?
 - a. Yes
 - b. No
 - c. Equal
6. Did you find the duration of the video correct?
 - a. Yes
 - b. No
 - c. Indifferent
7. Do you prefer this format to the traditional format?
 - a. Yes
 - b. No
 - c. Indifferent
8. From 0 to 10, how would you rate this experience?
9. From 0 to 10, how would you assess the degree of retention of the topic?

3. RESULTS AND DISCUSSION

Most of the students answered they watched the video the day before or the same day of the face-to-face class, and all considered the duration of the video correct.

Figure 1 shows the results of the scores obtained by the students on the practical activity performed. As it can be seen, 89% of the students had a score from 8 to 10. This indicates that the students acquired a good knowledge and a good retention of the topic studied.

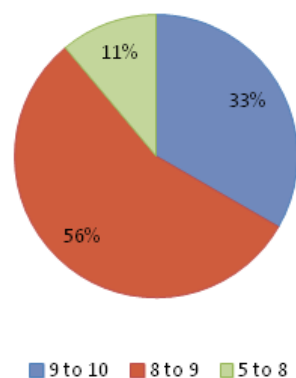


Figure 1. Student's scores on the final knowledge assessment activity (up to 10).

As can be seen in Figure 2, the students felt more motivated when learning using flipped classroom format. Also, the 66.7% of the students would like to have more flipped classrooms, as shows Figure 2.

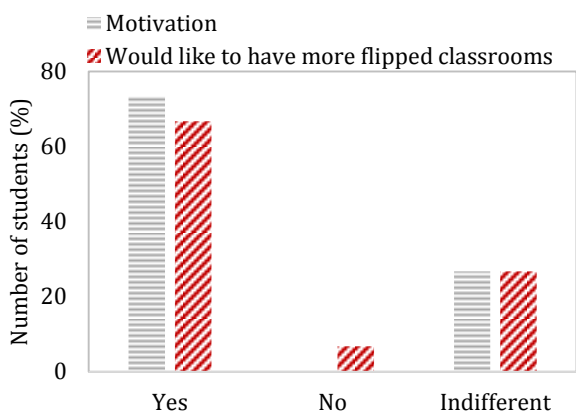


Figure 2. Student’s motivation with the flipped classroom and the results of the survey of the question if they would like to have more flipped classrooms.

The results about the interest in the topic using the flipped classroom can be seen in Figure 3. Most of the students had not a greater interest on the topic when learning using the flipped classroom format. However, a 26.7% of the students found the new format itself more interesting than the conventional one, and a 20% did not like the flipped classroom more than the conventional class format.

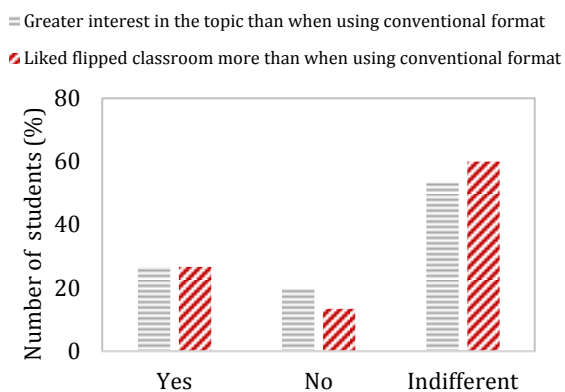


Figure 3. Student's answers about whether they are more interested in the subject when the flipped classroom was used and if they liked this format more than the traditional one.

The degree of retention of the topic felt by the students were greater than by the conventional method, as can be seen in Figure 4. A 73% of the students scored the degree of retention to a 7 or more to 10 points.

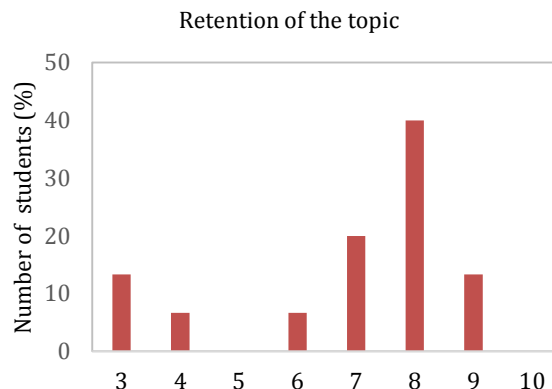


Figure 4. Student’s answers of the degree of retention about the topic studied with the flipped classroom method.

Figure 5A shows that a 67% of the students scored the degree of satisfaction with the activity in 8 points or more, and a 33% on the students scored the degree of satisfaction with the activity in 7 points or more, scores below to 7 points were not obtained.

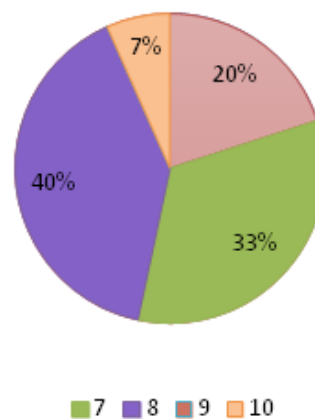


Figure 5. Student’s scores on the degree of satisfaction with the activity.

4. CONCLUSIONS

The main conclusions obtained in this study are the following:

- Student’s scores on the final assessment activity using flipped classroom method were positive.
- Students felt motivated and they would like to have more flipped classrooms during the course.
- Students had a greater degree of retention on the studied topic than using the

- conventional education system, which was confirmed with the positive
- scores obtained in the final assessment activity.
 - The satisfaction degree of the students with the new learning method was high.

It can be concluded that the new learning methodology is promising and beneficial for the students learning, because the students feel more motivated and the degree of the retention of the topic studied is high.

5. REFERENCES

- [1] OECD iLibrary., Innovating education and educating for innovation, 2016.
- [2] M. Forsey, M. Low, and D. Glance, "Flipping the sociology classroom: Towards a practice of online pedagogy," *J. Sociol.*, vol. 49, no. 4, pp. 471–485, 2013.
- [3] M. J. Lage, G. J. Platt, and M. Treglia, "Inverting the classroom: A gateway to creating an inclusive learning environment," *J. Econ. Educ.*, vol. 31, no. 1, pp. 30–43, 2000.
- [4] M. J. Lage, G. J. Platt, and M. Treglia, "Inverting the classroom: A gateway to creating an inclusive learning environment," *J. Econ. Educ.*, vol. 31, no. 1, pp. 30–43, 2000.
- [5] Z. Sun, K. Xie, and L. H. Anderman, "The role of self-regulated learning in students' success in flipped undergraduate math courses," *Internet High. Educ.*, vol. 36, no. September, pp. 41–53, 2018.
- [6] J. O'Flaherty and C. Phillips, "The use of flipped classrooms in higher education: A scoping review," *Internet High. Educ.*, vol. 25, no. February 2015, pp. 85–95, 2015.