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FLIPPED CLASSROOM EVALUATION USING KAHOOT AND MOODLE IN THE UNDERGRADUATE TEACHING LAB

Francisco Romero-Gavilán, Jorge García-Cañadas

Department of Industrial Systems Engineering and Design, Universitat Jaume I, Campus del Riu Sec (SPAIN)

Abstract

This article analyzes the implementation of a flipped classroom methodology in the undergraduate teaching labs of engineering degrees. The methodology is focused on providing the students, before the lab session, with audio-visual resources that cover the theoretical background and explanations needed to follow the session. At the beginning of each lab session, the preparatory work performed by the students is evaluated with an on-line test, which was performed using Kahoot and Moodle resources and has an impact on the mark of the session. This methodology is helpful in the sense that eliminates the frequently required theoretical introduction, allowing devoting more time to the experimental part. On the other hand, it provides an immediate information of the degree of prior knowledge gained by the students, so the weaker aspects can be reinforced during the lab session. An analysis of the advantages and disadvantages found for the two on-line resources employed, in conjunction with the impact produced on the students by the methodology is presented. Moodle was found to show greater seriousness and more versatility to introduce the test questions. However, the use of Kahoot was preferred by the students, since it creates a more relaxed lab atmosphere, which was also very useful to increase the participation of some students who were unmotivated. The students recognized that the methodology helped to better follow the lab sessions and improved the quality of their lab reports, which are the items used for their evaluation.

Keywords: Kahoot, Moodle, flipped classroom, teaching lab, materials science.

1 INTRODUCTION

In science and engineering degrees, teaching labs are a key experience for the students during the learning process, since they can prove the different theories taught in the lectures, which complements nicely their learning. A common procedure in teaching lab sessions is to provide, beforehand, a script to the students which details what each session consist in. Thus, the teaching lab methodology presupposes that students previously read this document, so they are able to properly follow the session progress upon their arrival at the lab. However, we frequently find that students attend teaching labs without having previously read the corresponding script. Therefore, they experience significant problems to follow the session and understand the concepts under study, which impacts on their final elaborated report, which is the element typically evaluated in order to provide the mark of each lab session.

Sometimes, an initial theoretical introduction is performed by the lecturer at the beginning of the lab session in order to solve this problem, but this has the disadvantage that requires certain time, which eventually reduces the time required for the experimental part of the lab session. To improve this scenario, a different methodology based on flipped classrooms has been proposed [1]. The methodology consists in providing the students beforehand with audio-visual resources that cover the theoretical background and explanations needed to follow the lab session. At the beginning of each lab session, the previous preparatory work performed by the students using the audio-visual resources is evaluated with a handwriting test. This methodology has previously reported an improvement of the learning of the students in conjunction with an enhancement of their marks [2]. Unlike this previous approach, we employ here an on-line test replacing the handwriting exam, which is performed employing different technological learning resources (Kahoot and Moodle). The final result obtained in the on-line test affects the mark of each lab session.

The use of technological resources for the test allow the teacher obtaining the statistics of the test results immediately, providing an instant feedback which is key to know the concepts or experimental procedures that should be reinforced during the lab session. We have used Kahoot and Moddle tools to perform the tests, and here we analyse the advantages and disadvantages of both methods, in conjunction with the impact produced on the performance of the students.

2 METHODOLOGY

This study was performed at undergraduate teaching labs of the Universitat Jaume I in Castellon (Spain), in the Science and Materials Technology subjects of electrical, industrial and mechanical engineering degrees. The subject comprises 4 lab sessions.

2.1 Flipped classroom

A flipped classroom methodology was initially implemented. The students were provided one week before each lesson with audio-visual resources that cover the theoretical background and explanations needed to follow the corresponding lab sessions. The audio-visual materials consist of videos of approximately 10 min length, which were uploaded to the Moodle space associated to the subject. As an example, the video used for the first lab session can be found in the link of Ref. [3].

In order to evaluate the previous preparatory efforts performed by the students using the audio-visual resources, on-line exams were performed at the beginning of each lab session using two different technological learning resources: Kahoot and Moodle. To do the exams, students used their own devices (smartphones or laptops) and then the session continued in the usual way.

Once the lab session is finished, the students have two weeks to prepare a report, which is used to evaluate them. In addition to this, their performance on the initial test is also taken into account by means of a correction coefficient. Scores from 0-5, 5-8, and 8-10 corresponds to coefficients of 0.8, 1 or 1.2, respectively. The final mark of each lab session is obtained by multiplying the mark achieved in the report by this correction factor. In this way, the students performing well in the exam obtain an increase in their mark, and the ones that did not properly prepare the lab session are penalized with a reduction on their final mark. Those students who performed normal do not find their mark modified.

2.2 Exam evaluation methodology

The exams performed followed a fixed structure. They comprise a set of 10 questions with four possible answers per question, being only one of the answers correct. The questions answered erroneously subtract 25% of the value of a correct answer. This is to prevent students from answering the test randomly. The time allocated to perform the exam was 8 min. As an example, three questions from the first lab session exam are shown in Table 1. This first session covered the metallographic preparation of materials to observe their microstructure at the optical microscope.

Table 1. *Questions employed in the initial exam of the first lab session, related to the metallographic preparation of materials to identify their microstructure. The correct answers are shown in bold.*

Question 1	Which hardness evaluation method will be used during the lab session?
	a) Vickers
	b) Rockwell
	c) Brinell
	d) Shore
Question 2	Which material will be tested in the session?
	a) High carbon steel AISI304
	b) Austenitic stainless steel
	c) Galvanized carbon steel
	d) Both galvanized carbon steel and high carbon steel AISI304
Question 3	What are the inclusions observed at the microscope?
	a) Dislocations in the material structure
	b) Grain or crystal boundaries
	c) Contaminant species from the metallographic preparation
	d) Non-metallic precipitates which can indicate the material origin and quality

Two different technological learning tools were evaluated to perform the exams: Kahoot (in classic mode), and Moodle. In the two first sessions the tests were performed through our university Moodle environment, while in the other two sessions Kahoot was employed.

In Moodle exams, students accessed the test through their own university student profile using a password, which was provided just before starting the test. Due to the Moodle system characteristics, both questions and possible answers appeared on the individual student device. In the case of Kahoot, students accessed the quiz using a code generated automatically by the software when the test is activated. With Kahoot the questions were shown on a screen located in the lab, and the responses were answered using the personal devices of the students. For Kahoot exams, students were asked to use their own name as nickname, or their student number if they wish to keep their performance confidential. Apart from the previously mentioned differences, both tools show a quite different web design and environment, as shown in Fig. 1. Being Moodle more serious and Kahoot more attractive and enjoyable.

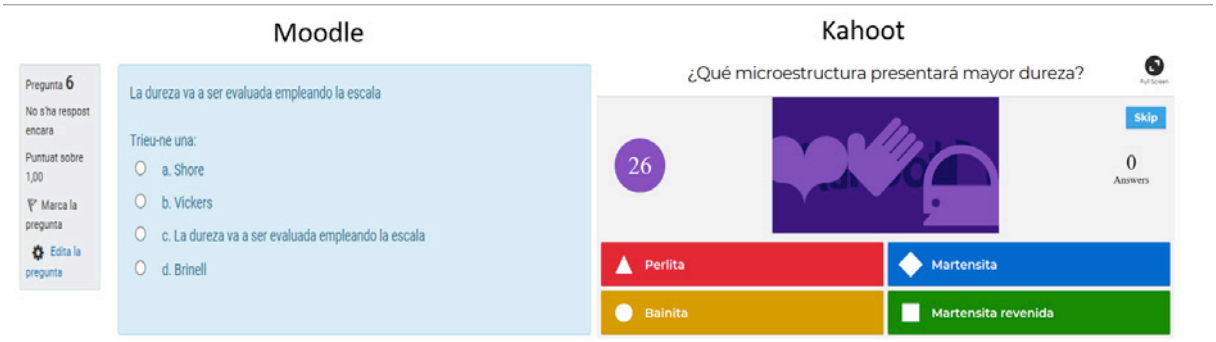

Figure 1. Web design and environment of Moodle and Kahoot (Spanish version).

2.3 Evaluation of the methodology

A survey was conducted to the students at the end of all the lab sessions in order to gather their opinion and views about the proposed methodology. The survey was set up with the aim of assessing the following points:

- The effectiveness of the flipped-classroom implementation.
- The acceptance level for the use of digital teaching resources to evaluate the students in flipped-classrooms.
- The appropriateness of Moodle and Kahoot for this specific application.

Table 2 shows the questions contained in the survey.

Table 2. *Survey performed to the students in order to evaluate different aspects of the implemented flipped classroom methodology.*

Q1	From 0 (nothing) to 10 (a lot), how much effort has meant the previous work preparation of the lab sessions for you?
Q2	Regarding the previous work preparation of the lab session, do you think it has helped you to better understand the session progress? a) No, I have not prepared the material. b) No, I neither have prepared the material nor have understood the session. c) Yes, it has helped me to better understand what we were doing during the session. d) Other.
Q3	From 0 (nothing) to 10 (a lot), do you think that the methodology followed in the classes has facilitated the preparation of your reports and has improved its quality?
Q4	Do you prefer the previous work evaluation through digital exams or the traditional paper format? a) Yes b) No c) Indifferent

Q5	What examination platform you consider most appropriate to evaluate the previous preparatory work of the lab sessions? Why? a) Moodle b) Kahoot
Q6	From 0 (nothing) to 10 (a lot), do you think that the use of Kahoot has motivated you to follow the flipped-classroom methodology?

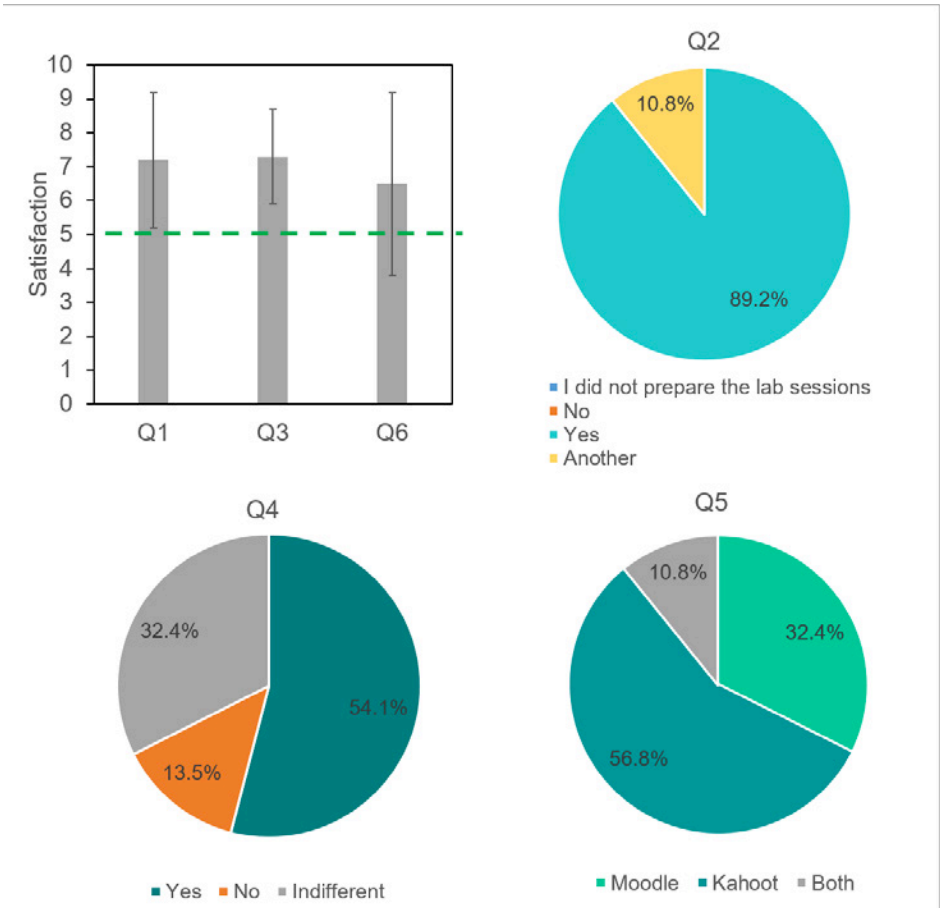

Figure 2. Results of the student survey of Table 1. Error bars indicate the standard deviations and the dashed line simply sets the reference value of 5.

In addition to the survey, the average scores obtained by the students with both Moodle and Kahoot tools in the different exams were calculated. Moreover, the percentages of students who achieved correction coefficients of 1.2, 1, and 0.8 in each session were also determined. These two calculations were performed in order to identify differences between the two applications used (Moodle and Kahoot).

3 RESULTS

A total of 39 students participated in the lab sessions. From our personal observations, the students maintained a reticent attitude to the new methodology at the beginning, since it meant a greater effort for them. This is also reflected in the responses to Q1 from Fig. 2, were ≈7 out of 10 was the average level of the effort dedicated by the students to the preparatory work. However, they adapted perfectly to the new class structure in the end. In addition, we also observed that the implementation of this methodology also improved the participation of students during the sessions, showing more interest in the explanations and formulating more questions to the lecturers.

Despite the greater initial effort performed by the students, 89.2 % of them recognized that the methodology adopted helped them to better follow the different lab sessions, as well as to elaborate better reports, as it can be seen in the results of Q2 and Q3, respectively, in Fig. 2. This proves the suitability of the flipped classroom methodology proposed.

Regarding the use of digital exams to evaluate students in flipped-classrooms, the survey reveals that 54.1 % of the students prefer this type of exams, compared to only a 13.5 % which prefer the traditional way (see results from Q4 in Fig. 2). There is also a 32.4 % of students which find both methods fine, so although digital exams are preferred, the difference is not very large. It is important to add here that the use of digital exams facilitates teachers to have instantaneously the results of the exams, and thus know which points should be reinforced during the progress of each lab session.

Regarding the analysis of the most appropriate platform for this specific methodology, it can be found from the results of Q5 in Fig. 2 that 56.8 % of students preferred Kahoot, with respect to a 10.8 % of students that chose Moodle. The reasons given are related to the fact that Kahoot is more dynamic and creates a funnier lab atmosphere. In fact, some of the students considered that Kahoot motivated them to better prepare the sessions. On the other hand, the students that considered Moodle more suitable mentioned that they prefer it for being more serious.

The perception of the lecturers was similar. Moodle gave a greater seriousness and rigor to the exam. In addition, this platform provides greater versatility for the exam design. On the other hand, Kahoot impose more restrictions to the format of both the questions and the possible answers, being more direct. In turn, its use created a more relaxed lab atmosphere since the beginning, a factor that favors the student participation during the lab session. In addition, we observed that Kahoot made that the most unmotivated students showed less reluctance to the extra effort associated to the flipped-classroom methodology (see results of Q6 in Fig. 2).

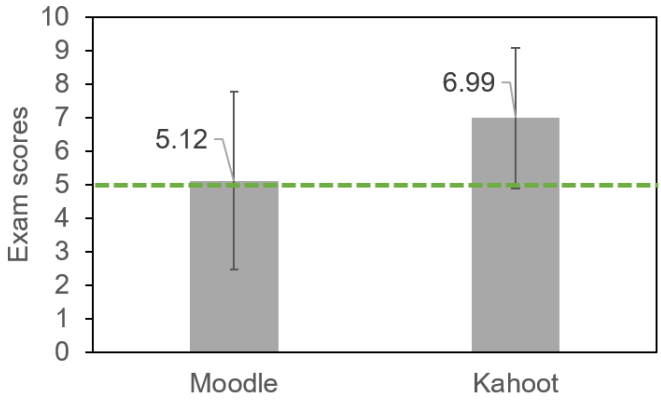

Figure 3. Average score of both Moodle and Kahoot exams. Error bars indicate the standard deviations and the dashed line simply sets the reference value of 5.

Fig. 3 shows the average scores obtained in the exams depending on the application used. It can be observed that the use of Kahoot produces better results. In addition, Table 3 shows the percentage of students which achieved the different correction factors for the two exam evaluation tools employed (Moodle and Kahoot). A 1.2 correction factor is higher in the Kahoot exams. However, it is difficult to establish if this effect is only a consequence of this application. As we used Moodle in the first two sessions and Kahoot in the last two, students could be more used to the flipped class methodology during the Kahoot sessions, which could have influenced in these results.

Table 3. *Data regarding students who achieved correction coefficients of 1.2, 1 and 0.8.*

	Moodle		**Kahoot**	
Correction coefficient	Session 1	Session 2	Session 3	Session 4
0.8	49%	41%	27%	16%
1	26%	46%	41%	41%
1.2	26%	14%	32%	46%

4 CONCLUSIONS

An implementation of a flipped classroom methodology in the undergraduate teaching labs of engineering degrees has been performed. The methodology is focused on providing the students, before the lab session, with audio-visual resources that cover the theoretical background and explanations needed to follow the session. At the beginning of each lab session the preparatory work performed by the students is evaluated with an online test, which was performed using Kahoot and Moodle on-line resources. This test had an impact on the mark of the session.

The methodology was successful, since despite the greater effort required by the students, they recognized that it helped them to better follow the lab sessions and improved the quality of their lab reports, which are the items used to evaluate them. Differences were observed between the use of Moodle and Kahoot. Moodle exams have greater seriousness and more versatility to introduce the test questions. However, the use of Kahoot provides a more relaxed atmosphere and were preferred by the students. In addition, Kahoot was very useful to increase the participation of some students with lower motivation.

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REFERENCES

[1] J. O’Flaherty and C. Phillips, “The use of flipped classrooms in higher education: A scoping review,” *Internet High. Educ.*, vol. 25, pp. 85–95, Apr. 2015.

[2] J. Gonzalez Ausejo, R. Oliver Valls, J. Gámez Pérez, and L. Cabedo Mas, “Óptimo aprovechamiento de las sesiones de laboratorio,” in *IN-RED 2017*, 2017.

[3] https://www.youtube.com/watch?v=VOXDAdKd0IM.

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