

# The Use of New Learning Technologies in Higher Education Classroom: A Case Study

Micaela Esteves<sup>1</sup>(✉), Angela Pereira<sup>2</sup>, Nuno Veiga<sup>1</sup>, Rui Vasco<sup>1</sup>,  
and Anabela Veiga<sup>3,4</sup>

<sup>1</sup> CIIC - Computer Science and Communication Research - ESTG,  
Polytechnic Institute of Leiria, Leiria, Portugal  
{micaela.dinis,nuno.veiga,rvasco}@ipleiria.pt

<sup>2</sup> CiTUR - Tourism Applied Research Centre - ESTM,  
Polytechnic Institute of Leiria, Leiria, Portugal  
angela.pereira@ipleiria.pt

<sup>3</sup> Geosciences Center of the University of Coimbra, Coimbra, Portugal

<sup>4</sup> Polytechnic Institute of Leiria, Leiria, Portugal  
anabela.veiga@ipleiria.pt

**Abstract.** We have conducted a study with higher level education students, in lecture classes of three Undergraduate Courses and one Professional Higher Technical Course that involved six different subjects with a total of 324 students. In this research the use of Game-Based Learning platform was analysed in order to encourage the students' participation, increasing motivation and keeping them motivated and committed during lessons, therefore, increasing their learning skills.

Based on these results, we recommend that Kahoot is used in lectures in order to help students develop their performances and abilities and at the same time be more successful and prepared to have an active participation in society.

**Keywords:** Learning · Collaborative learning · Game-Based Learning  
Higher education

## 1 Introduction

During the recent years, there has been an increase in the participation rates of students in higher level education, mainly due to the Bologna process, and inevitably therefore an overall lowering of academic standards as universities and student populations have become more diversified [1]. There are still dedicated hardworking students in universities, however many of them have a low profile for higher education [2]. These changes have brought many challenges for teachers who have had to adapt their teaching methods according to students different characteristics and backgrounds.

In Portugal, as in other countries, the engineering areas deserve special attention from higher education institutions due to the low success rates and also because of the high dropout rate that is compared to other course rates. According to Paura and Arhipova [3] the main reasons for students' abandoning their studies is due to poor teaching and advising as well as the high difficulty level of the engineering curricula.

The difficulties of the engineering curricula are associated with the studied topics such as mathematics, physics and computer programming. Different studies show that the students' dropout rate depends on the studied subject at the university as well as their pre-college academic qualifications [4, 5]. On the other hand, today's students bring a rich and different set of literacy practices and background that is often unacknowledged or underused by educators, namely their use of Information and Communication Technology (ICT). All these issues lead to a high dropout rate and failing, especially, in the engineering areas.

In these times of rapid technological changes, the challenge for today's teachers is to build a bridge between the technological world that students live in and the classrooms in which teachers expect them to learn in, especially in higher education. These students are being referred to as the Millennials [6] once they are the first generation to be immersed in ICT for their entire lives. Considine et al. [7] argue that *"to develop a curriculum that is relevant to this generation, educators need to acknowledge and respect the skills, attitudes, and knowledge that students bring with them to school and build on those to ensure success in the academic disciplines. Thus, students will become engaged and connected to the traditional curriculum while developing crucial technological skills."*

Due to the computerization society, education has been accompanying technological innovations. In this context, several digital applications for Game-Based Learning (GBL) purposes have emerged in higher education classrooms. These games should be aligned with the learning styles and needs of this current generation, the Millennials.

We propose the use of a GBL platform through mobile devices in the classroom to allow students to collaborate with each other, in order to encourage and increase their participation and motivation, during the lessons, therefore increasing their learning effectiveness. This paper includes a reflection on how using the game-based learning platform during lessons could improve learning experiences for students in higher education, mainly in engineering courses. In this context, this article presents the usage of Kahoot with higher education students from School of Technology and Management, Polytechnic Institute of Leiria, during the academic year 2016/2017 from September to May.

The rest of the article is organised as follows. Section 2 our motivation and related work is outlined. Section 3 describing the methodology of the project. In Sect. 4 we follow with the findings and the discussion. Finally, some conclusions of this study are presented in Sect. 5.

## 2 Related Work

The usage of Game-Based Learning (GBL) has been explored in recent years for educational purposes due to the ability to commit students to the task that they are working on and pushing them to work to the edge of their capabilities [8–11].

According to Whitton and Moseley [9] GBL has the ability to provide a scaffold for learners to gradually increase their knowledge and ensure that they are motivated to pursue additional content. Furthermore, games provide immediate feedback to the

learners and can reinforce content and help students with the retention of concepts [12, 13].

The study carried out by Cheng and Su [14] makes a comparative study between traditional teaching methods and the Game-based Learning (GBL) approaches. The results show that when using games, the students' motivation has a significant impact on learning, allowing us to assert that GBL can achieve the learning goal effectively.

On the other hand, GBL stimulates the collaboration between students. Collaborative environments can offer important support to students in their activities for learning. According to Guzdial et al. [15], collaborating in problem-solving provides not only an appropriate activity but also promotes reflection, a mechanism that enhances the learning process. Students that work in groups need to communicate, argue and give opinions to other group members, encouraging a reflection that leads to learning.

One educational tool that can be used to promote the collaboration in class is Kahoot. Kahoot is a game-based learning platform that has been used in university field studies in different areas such as Mathematics, Physics, Languages and others. Nevertheless, some authors [16] argue that using mobile technology does not guarantee effective learning.

Kahoot is a free tool that has gained popularity amongst teachers for it being easy to use and its ability to establish dynamics of active work in the classroom. This application allows teachers to create quizzes, jumbles, surveys, discussions and also to obtain feedback from students in real time.

Kahoot has been used in higher education context. Studies [17, 19] evaluating the usage of Kahoot, show that this is a good GBL tool for classroom activities and also helps to improve student participation by promoting a positive relationship between groups. On the other hand, Cerro Gómez [18] emphasizes that the usage of Kahoot has led to an increase in the number of students attending classes. Buchanan et al. [20] argue that the existence of an alignment between the learning goals and the game design is important, which is possible to achieve whilst using the Kahoot GBL.

### 3 Methodology

This case study was carried out in the current school year, 2016/2017, in lecture classes of three Undergraduate Courses and one Professional Higher Technical Course and involved six different subjects with a total of 324 students. All subjects clearly fit into technological courses, with the exception of the undergraduate course, Health Information Sciences, which has also an interconnection with healthcare. All lecture classes lasted for 100 min, with the exception of one lasting only 50 min (Networks Laboratory I) and also had a different student attendance average.

Several Kahoot quizzes were applied in lecture classes and all of them were carried out with student teams. All Kahoot quizzes were always held at the end of the lecture, with the exception of Computational Systems (CmpS) subject. This allowed to validate the degree of attention and the consolidation of the contents from the students. In CmpS subjects with classes lasting 100 min, Kahoot was randomly interleaved as the lecture evolved. In addition to the previous objectives, this also allowed time to pause

with the objective of regaining the students power of concentration and also to keep them motivated.

Three assessment methodologies (AM1, AM2, AM3) were chosen for evaluating the Kahoot effectiveness in the classroom (Table 1). The Comparison between the traditional approach versus Kahoot (AM1) was only performed on CmpS subject and was done by comparing the present subject student grades with those achieved in the preceding school year (without the use of Kahoot). This was possible because the students profile was identical in both years.

The analysis of the Kahoot approach acceptability and applicability was undertaken in two ways: team feedback (AM2) and an individual Kahoot survey (AM3). The individual survey included closed questions and open questions with regard to suggestions (Table 3).

**Table 1.** Overview of the case study

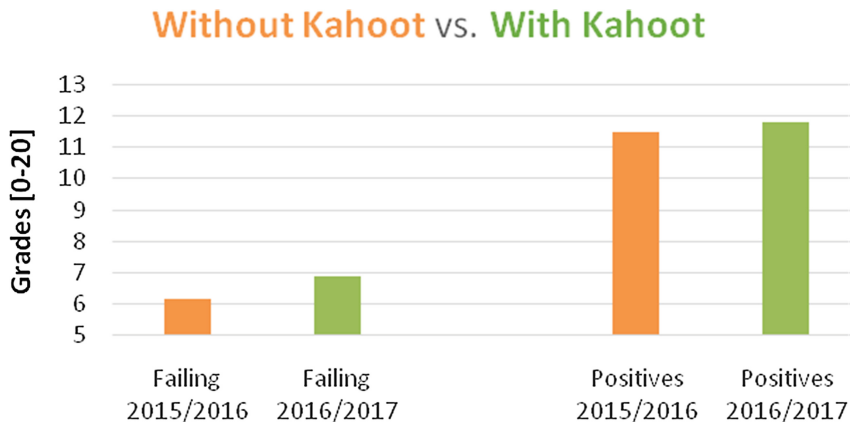
Subject acronym	Subject	Course	Average number of students in class	Assessment methodologies
CmpAT	Computer Architecture and Technology	Undergraduate in Health Information Sciences	20	AM2 and AM3
CmpNT	Computer and Network Technology	Undergraduate in Games and Multimedia	41	AM2 and AM3
CmpS	Computational Systems	Undergraduate in Computer Engineering	177	AM1 and AM2
NLab	Networks Laboratory I	Computer Networks and Systems Professional Higher Technical Course	25	AM2 and AM3
SoilMF	Soil Mechanics and Foundations	Undergraduate in Civil Engineering	14	AM2
VirtT	Virtualization Technologies	Undergraduate in Computer Engineering	47	AM2 and AM3

## 4 Results and Discussion

### 4.1 Comparison Between the Traditional Approach Versus Kahoot

In the subject of CmpS, the average theoretical grade has improved by 6.4%, from 8.86 out of 20 in the 2015/2016 school year (without Kahoot) to 9.57 in 2016/2107 (with Kahoot). There were no other significant changes in the operation of the subject, with contents and the teaching team remaining the same.

It should also be noted that there is a higher impact on lower grades with the failing students' scores improving 12%, from 6.17 out of 20 to 6.91, closer to success. The positive average rose 2.8% (Fig. 1).



**Fig. 1.** Student average results [0–20] without and with Kahoot

These results are in line with the study carried out by Cheng and Su [14] showing the effectiveness of the tool in the learning process. Teachers could observe the positive impact on students’ motivation. As for a possible cognitive influence assessment, more studies will be necessary in the future.

4.2 Analysis of the Kahoot Approach Acceptability and Applicability

With regard to the analysis of Kahoot applicability (Table 2) the results show that there is a high percentage average of correct answers of the three best teams, despite the fact that they have been evaluated right after the presentation of the contents, therefore without prior study. Thus, we believe that Kahoot can help students focus in class.

Some teams revealed difficulties in accessing Kahoot, either due to Wi-Fi problems or lack of hardware capacity, causing some teams to be unable to answer a considerable amount of the questions, being evaluated as “wrong” answers. This may partly explain the significant difference of the overall average (61%) in item 1 (Table 2) “Correct answers” to the 1<sup>st</sup> place average (86%) in item 1.1.

**Table 2.** Results of Kahoot acceptability and applicability

Item	Average	Standard deviation	Median
1. Correct answers	61%	13%	61%
1.1. Correct answers of 1 <sup>st</sup> place	86%	19%	89%
1.2. Correct answers of 2 <sup>nd</sup> place	79%	19%	75%
1.3. Correct answers of 3 <sup>rd</sup> place	73%	23%	73%
2. How fun was it? (1 to 5)	4.3	0.5	4.4
3. Did you learn something?	92%	13%	100%
4. Do you recommend it?	94%	10%	100%
5. How do you feel?			
5.1. I feel positive	75%	20%	78%
5.2. I feel neutral	11%	11%	11%
5.3. I feel negative	15%	16%	13%

The results also emphasise the high average values of positive feedback, revealing a clear impact on student motivation. We highlight the medians of 100%. About the Kahoot acceptability the majority of students approved and appreciated it. However, 15% do not feel so comfortable with the use of this application.

In order to better understand the students' acceptance of Kahoot, we underwent satisfaction survey that was answered by 84 students, 23% of the students were female and 24% of the students attend the CmpAT subject. The survey results are presented in Table 3.

The analysis of the ease of technology handling by the students, reflects their digital skills. The survey results corroborate that the use of Kahoot contributes to consolidate students' knowledge. Concerning the time available per question and the quantity per Kahoot it was considered adequate. The results about the importance of podium and the reward attribution were not consensual once they present high standard deviations. This reveals that students do not give importance to the prize but rather to the pleasure of playing.

**Table 3.** Results of individual survey

Questions	Average (1 to 5)	Standard deviation	Median
1. Do you feel comfortable using electronic gadgets (smartphones, tablets, laptops, ...)?	4.60	0.56	5
2. Does Kahoot contribute to the consolidation of the subject contents?	4.12	0.66	4
3. Will Kahoot contribute to better individual grades?	4.05	0.58	4
4. How fun was it?	4.37	0.77	4,5
5 Was the Kahoot question response time adequate?	3.02	0.38	3
6. Was the Kahoot number of questions adequate?	2.94	0.32	3
7. How important is the scoreboard?	3.68	0.97	4
8. Do you agree with the reward?	3.43	1.00	3
9. Do you recommend Kahoot?	4.30	0.70	4

Having only a few students answer the comments section. Those who did, were in general enthusiastic about using Kahoot and encouraged the continuation of its usage, as can be seen in the following answers examples: *"I loved Kahoot!"*; *"At the beginning Kahoot seemed like a joke, but then I realized its great benefits. Thank you!"*; *"The subject contents are hard and very theoretical. Kahoot helped a lot lightening the burden."*; *"A good interaction moment and a fun way of reflexion on the contents."*; *"Strengthening of team work and relationship between fellow students"*.

## 5 Conclusions and Suggestions

Currently, educators are facing difficult times with a whole generation that was born surrounded by technology and that are subject to completely different stimuli from their teachers and parents. Researchers have recognized that these students learn differently thus teaching should adapt to avoid abandonment and improve the success of these digital natives.

The result of this study shows that students are more committed to learning in the classroom. Moreover, the number of students per class increased, softening a problem in our institution. Consequently, the learning results were better therefore it is our intention to spread the use of Kahoot in classrooms of other courses.

In this study, Kahoot was used as a way to assess and consolidate contents, as well as a way to regain power of concentration. However, we suggest other forms of using it: in the beginning of the next class to access and consolidate the contents of the previous class or simply as a diagnostic test, allowing the teacher to know the students' previous knowledge about the subject and motivating them to the learning process.

Based on our experience in teaching in higher education, we believe that using this type of applications could reduce the gap between student's way of life and the classroom environment, once mobile technology is intricately interwoven in their lives.

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