

# Using Kahoot! to Enhance the Motivation of Undergraduate Students of Tourism in Mathematics Classes - A Case Study

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**Abstract:** Nowadays we live in an ever-changing society. The educational context is no exception and requires a renewal of paradigms. Profound changes to the role and function of the professor and the students are particularly vital. Active, cooperative and participative methodologies of learning must be privileged, breaking with magisterial education and the mere transmission of knowledge.

Mathematics is one of the school subjects where demotivation is a frequent concern. Relating mathematics with other areas usually draws students' attention and increases their involvement in the classes. It is necessary to go beyond the traditional; the teacher must look for resources that make his classes flow, so that the students acquire or increase their interest in mathematics.

In the last few decades, technology has advanced in multiple fields, including education. Some of its benefits include improving student performance and motivation, fostering active learning, and tracking student progress. Kahoot! is an example of a platform that can be used for reviewing content and motivating students for learning. The main reasons for choosing this tool are related to the fact that the application is accessible online free of charge, allows an intuitive use, both by the teacher/author and by the student/player and allows the participation of the whole class in an interactive, stimulating, and playful way.

The teachers involved in this study began using Kahoot! in their classes as an alternative teaching methodology. The participants in the study are undergraduate students from a Portuguese higher education institution and encompassed the curricular unit of Statistics. The aim of the study is to investigate students' perceptions of how Kahoot! can be used as a tool for reviewing class content or designing warm-up activities. A survey was conducted to gather information about students' insights on the use of Kahoot!. Similar studies have shown that higher education students are usually receptive to the use of this tool, finding it useful to increase their motivation and consider technology can positively impact learning.

**Keywords:** educational games, game-based learning, higher education, motivation, Kahoot!.

## 1. Introduction

In recent decades, the integration of technology has played a fundamental role in various sectors of society and its transformative power at various levels is undeniable.

In the educational context, more specifically in higher education, information and communication technologies (ICT) enhance a set of advantages at the pedagogical level, ranging from increased motivation for learning (Golonka et al, 2014) to the possibility of periodically monitoring learning outcomes (Johns, 2015), which allows students to assess their ability to understand and assimilate information.

Learning based on digital games appears as a trend that is widespread throughout the world. Educational games stimulate students' interest in the classroom, as they allow the teaching of content in a playful way. In addition, it is possible to learn from mistakes, reconciling stimulus and fun (Minussi and De Souza Wyse, 2016). The use of these types of games has a positive influence on the development of important cognitive skills such as, strategy planning, concentration, multitasking, competition (González et al, 2016; Pais et al, 2018;).

Mathematics, considered one of the basic areas of various formations, has been the subject of concern for many authors and researchers due to its tremendous academic and educational failure (Faulkner et al, 2014). Its significance in day-to-day life and in the formation of individuals is incontestable. One of the problems identified in the failure of mathematics teaching is the lack of motivation that students feel towards the subject. According to several authors, motivation is an essential factor in any learning since the quality of learning is not only related to the capacity to learn, but also to the level of motivation that we must have to

carry out that same learning (Entwistle and Ramsden, 2015). In the case of mathematics, technology has become essential because the teaching and learning processes are enriched with the use of technology, improving the students' motivation and the students' learning process (Bullon et al, 2018; Zabala-Vargas et al., 2019). ICTs are tools that innovate the way mathematics is taught and they may facilitate students' learning (Scanlon et al, 2005).

The use of the Kahoot! platform has been extensively investigated (Jamil, Fatima & Saeed, 2018; Plump and LaRosa, 2017; Wang and Lieberoth 2016) and emerges as an example of the integration of Web 2.0 tools in teaching, taking advantage of the students' own smartphone use, following the Bring Your Own Device (BYOD) methodology. Portuguese researchers analyzed the use of a game-based learning platform, which included Kahoot!, and concluded that there is a set of advantages associated with this resource (Esteves et al, 2017).

This article includes a reflection on how the use of a specific game-based learning platform, Kahoot!, can improve the learning experiences of students in higher education, especially students in the field of Tourism. Within the course of Statistics, the researchers resorted to Kahoot!, accessed by students through their mobile devices, in order to revise contents throughout the semester and to encourage and increase their participation and motivation during classes.

## **2. Methodology**

The purpose of this study is to investigate students' perspective on the use of Kahoot! in higher education, specifically in the subject of Statistics. The authors decided by a case study, with essentially exploratory intentions. To develop this experience, the following instruments were used: survey; records of the students' results automatically registered in the Kahoot! platform and field notes. In this article, we present an analysis of the survey results and of the reports and feedback data provided by the Kahoot! platform.

The Kahoot! application was used in three lecture classes, each corresponding to the conclusion of a syllabus topic. All Kahoot! quizzes were applied in the end of the lecture and took about 30 minutes. Altogether four quizzes were applied since in the first class two consecutive quizzes were applied, related to different sub-topics. The quizzes were used as a means to improve motivation and at the same time as a resource for content review and a consequent opportunity for clarifying questions about the topics taught.

Quantitative and qualitative data were collected through a survey. Some general questions were adapted from Esteves et al (2017) and other questions were added in order to analyse the impact of Kahoot! in the area of mathematics. The need to adapt the questionnaire was due to the particular context of the students and area of study of our research (a mathematics course within an undergraduate degree in Tourism). Statistical analyses were performed with Excel and Statistical Package for the Social Sciences (SPSS), version 26.

### **Participants**

The case study was developed in an institution of higher education of the central region of Portugal. It involves students from the undergraduate degrees in Tourism and encompasses the course of Statistics, which took place in the second semester of the academic year, 2019-2020. The case study included a total of 32 students (22 (68,75%) female and 10 (31,25%) male respondents), ages ranged from 18 to 25 years and 28 (87,5%) were enrolled for the first time in the course. This was a convenience sample, as participants were easily accessible to researchers.

### **Study description**

Kahoot! was used in the topics of descriptive statistics, contingency tables, and linear regression. During the classes, several strategies were used: exposure of contents, viewing of videos prepared by the teacher, use of Excel and SPSS, and of Kahoot!. Due to the pandemic situation, since March 13, the classes started to be online and Kahoot! was also played online, with all the limitations that this brought, such as, some students having problems with internet access, old and slow computer equipment, etc. Thus, the teacher chose to decrease the number of times planned for the use of Kahoot!. It was used only twice during the online regime: a quiz at the end of the topic contingency tables and another at the end of the topic linear regression, both with 8 questions. Before the pandemic situation, the teacher had given two quizzes (on the same day) at the end of the topic descriptive statistics: one with 10 questions and the other with 11 questions (see Table 1). Despite the restrictions associated with the pandemic situation and some isolated technical problems previously mentioned, in general, Kahoot! worked out well.

**Table 1:** Summary of the Kahoot! quizzes

Topic	Date	Nr. of Questions
Descriptive Statistics	20/02/2020	11
Frequency Table	20/02/2020	10
Linear Regression	07/05/2020	8
Crosstabs	21/05/2020	8

An example of the presentation of the quizzes is given in Figure 1, illustrating one of the questions in the “Linear Regression” quiz. The question appears on top of the screen. The answers appear on the bottom. On the left is a countdown clock (in seconds) and on the right the number of answers already given in by the students.

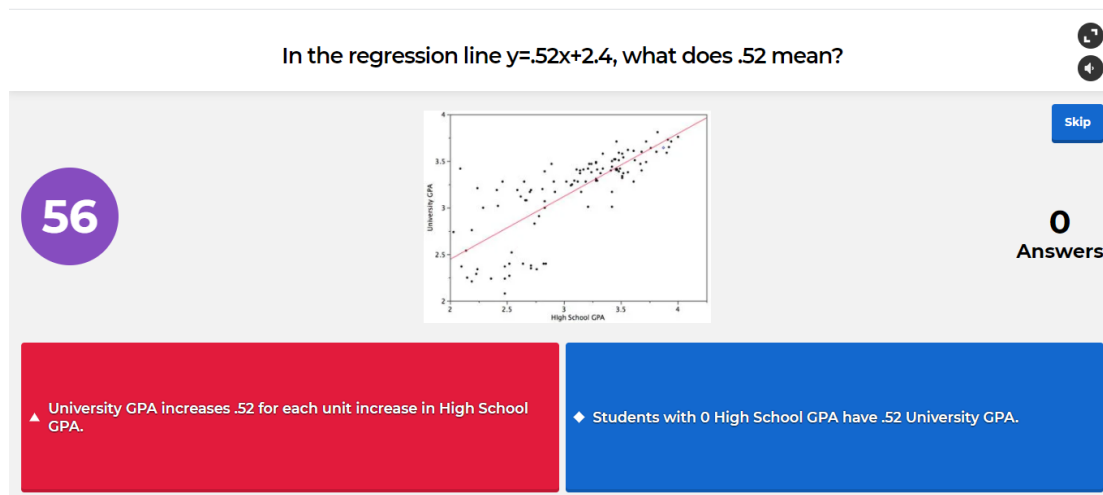


Figure 1. Snapshot of the Linear Regression quiz

Next, we give some examples of questions from the “Descriptive Statistics” quiz to illustrate the context of this study.

What do you associate “median” with?

- half-way ✓
- most frequent
- average
- largest

The median between 2 and 3 is

- 1
- 2
- 2.5 ✓
- 3

Which is the mode of this data set? 5, 8, 4, 5, 6, 5, 9, 7, 3

- 6
- 4
- 3
- 5 ✓

What is the range?

- The difference between the largest and the smallest value ✓
- The average
- The most frequent value
- The largest value

In all quizzes, whenever any student failed to answer correctly, the teacher took the opportunity to explore the situation and explain how to obtain the correct answer. The teacher tried to use, as much as possible, the Kahoot! quizzes as opportunities for learning and not just for playing.

In the end of the semester students were asked to answer a survey concerning the use of Kahoot! in the classes. An analysis of the responses is given in the next section.

#### 4. Results and discussion

##### Kahoot! outputs analysis

We start with a general analysis of the Kahoot! quizzes' results. Table 2 shows a summary of the quiz reports automatically provided by the platform. In average, the quizzes had 9.3 questions, 67.6% correct answers; 28.5 participants, 1.3 difficult questions, 0.5 participants needing help and 2.0 participants who didn't finish. The quiz with the best results was the "Frequency Table" one and the one with worst results was "Linear Regression".

**Table 2:** Summary of the Kahoot! quizzes performance

Topic	Correct Answers
Descriptive Statistics	63%
Frequency Table	90%
Linear Regression	52%
Crosstabs	66%

At the end of each quiz, students were asked to provide their feedback using the "feedback" facility available in Kahoot!. Table 3 shows a summary of the feedback reports.

**Table 3:** Feedback from the Kahoot! quizzes

	Descriptive Statistics	Frequency Table	Linear Regression	Crosstabs	Average	Standard Deviation	Median
How fun was it? (out of 5)	4.71	4.84	5.00	5.00	4.89	0.14	4.92
Did you learn something? (% of Yes answers)	100	100	100	100	100	0	100
Would you recommend it? (% of Yes answers)	96.87	100	100	100	99.22	1.56	100

The results in Table 3 show that students had fun using Kahoot! (the average total score of the 4 Kahoot! quizzes is 4.89 in a five point Likert scale, 1 to 5). They also show that all students consider having learned something when performing the Kahoots. Regarding the question "Would you recommend it", in 3 out of the 4 Kahoots carried out, all students gave a positive answer. Only in the first Kahoot (on Descriptive Statistics) a small percentage of students (3.13%) said they would not recommend it. Through the average total score of the four Kahoots, we observe that 99.22% of the students recommend its use.

The results shown in Table 3 also emphasise the high average values of positive feedback, revealing a clear positive impact on students' motivation. We highlight the medians of 100%.

##### Questionnaire analysis

In order to better understand the students' acceptance of Kahoot!, a satisfaction survey was delivered at the end of the semester. The questionnaire was answered by 23 students and a summary of the responses is presented in Table 4.

**Table 4:** Summary of the satisfaction survey responses (answers on a Likert scale: 1-total disagreement, 5-total agreement)

	Average	Standard Deviation	Median
I feel comfortable using electronic gadgets (smartphones, tablets, laptops, ...)	4.30	0.82	4.00
Game-based learning tools (like Kahoot!) motivate me	4.35	0.98	5.00
The use of Kahoot in the classroom contributes to consolidate the subject contents	3.96	1.02	4.00
The use of Kahoot in the classroom makes learning more interesting	3.91	1.12	4.00
The use of Kahoot in the classroom facilitates the learning process	3.70	1.18	4.00
The use of Kahoot in the classroom contributes to a more positive attitude towards mathematics	3.78	0.95	4.00
The use of Kahoot in the classroom increases motivation	4.30	0.97	5.00
The question response time was adequate	3.61	1.03	4.00
The number of questions was adequate	4.17	0.89	4.00

Analyzing the results of the questionnaire presented in Table 4, we observe that the mean and median values are clearly positive for all questions. Students' digital skills are reflected on their high ease of technology handling. The results of the central part of the questionnaire (questions 2 to 6) corroborate that Kahoot! is not only a motivating factor for students, but it also contributes to the content consolidation, and makes learning more interesting. Concerning the response time per quiz question, although with a positive result, it has the lowest average (3.61 out of 5). This is probably because in some cases students didn't have enough time to answer the questions.

In general, the standard deviation values reflect some variability, which is an indicator of some lack of consensus. Nevertheless, the results are quite positive, and we can only conclude that it is impossible to please everyone, and it is unlikely to captivate everyone's attention and to motivate all students without exceptions. However, knowing that most students enjoyed using Kahoot! is a very positive result of this study.

#### Field notes analysis

The analysis of the data collected through the teacher's field notes (simultaneously one of the researchers) confirms the results presented along this section. The teacher was able to observe that, in general, the students were enthusiastic about using Kahoot! and encouraged its continuous use. Next we transcribe some of the comments made by the students, concerning the use of Kahoot! during classes:

- "I loved Kahoot!"
- "At first it seemed like a joke, but then I became aware that it helped me to realize if I had understood the content or not."
- "I really enjoyed using Kahoot! in classes, it made them a little more fun."
- "It helped me understand which subjects I had difficulties on."
- "A fun way to review and reflect on contents."

Comparing our results with previous ones, we conclude that other studies show similar conclusions, not only about higher education students feeling comfortable using technological gadgets and specifically mobile devices (Anshari et al, 2017; Hamidi and Chavoshi, 2018), but also finding the use of Kahoot! fun and entertaining, particularly in maths (Bullon et al, 2018). More specifically, maths students find this platform to be beneficial, as it allows them to "self-evaluate their learning process" (Curto Prieto et al, 2019, p. 10).

## 5. Conclusions

The present generation of higher education students was born immersed in technologies. Throughout their lives they have been subject to a completely different set of stimuli, both from their educators and from the environment. Researchers recognize that these students have developed new ways of learning. Schools and universities must adapt themselves to the present challenges and adopt strategies to reduce school drop-out rates and to improve the educational success of these digital natives.

The results of this study show that the use of a game-based learning platform, like Kahoot!, increases students' engagement and their motivation for learning, by making learning fun. Other studies show similar results (Esteves et al, 2017; Pais et al, 2018; Wang et al, 2016; Wang and Tahir, 2020).

The analysis of the questionnaire allows us to conclude that using Kahoot! in the classroom contributes to consolidate the subject contents as well as to a more positive attitude towards mathematics, makes learning more interesting and facilitates the learning process.

In addition, students have a positive perspective about game-based learning and consider Kahoot! an effective tool which promotes learning.

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