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EXPLORING FLIPPED CLASSROOM AND CONTINUOUS ASSESSMENT – A CASE STUDY INVOLVING GENERATION Z UNDERGRADUATE TOURISM STUDENTS

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Abstract

The flipped classroom is an active, student-centred teaching-learning methodology. It aims to increase the quality of time spent in the classroom. This approach quickly spread throughout the world and has attracted the attention of teachers and researchers from different areas. As Mathematics teachers, the authors are faced with students' lack of interest and consequent failure in the subjects in this area. In an attempt to increase students' interest and commitment, one of the authors decided to use the flipped classroom model in one of her courses. In an effort to further strengthen student commitment, a continuous class assessment methodology was also used. Students were aware that any and all activities carried out in the classroom could be considered for evaluation. To understand how these changes were perceived by the students, a quantitative survey was conducted. The participants in the study are undergraduate students from a Portuguese higher education institution enrolled in the course of Applied Statistics, from the 2nd year, 1st semester of Marketing for Tourism degree. The didactic approach adopted by the teacher and the activities developed made the learning process more interesting and promoted a more positive attitude towards Statistics.

Keywords: *Flipped classroom, pedagogical innovation, math education, continuous assessment, higher education, Generation Z.*

1. Introduction

Mathematics, considered a foundation subject in most higher education degrees, has been a cause for concern for many authors and researchers due to the enormous academic and educational failure to which it has been subjected. (Pais, Cabrita & Anjo, 2011; Faulkner et al., 2014; Pais & Hall, 2021; Santos et al., 2021; Maharjan, Dahal & Pant, 2022). The lack of interest and motivation that students feel towards the subject is one of the problems identified in the failure of the teaching-learning process of Mathematics. It is fundamental to reverse the existing and widespread feeling towards Mathematics, it is necessary to motivate, encourage taste and interest, thus promoting the success of students in mathematics subjects (JMC, 2011).

Changes are needed in the teaching-learning process, starting with the role of the teacher and the student. The process should be centred on the student's learning, respecting the pace, and learning style of each one (Felder & Brent, 2005). The biggest challenge that teachers face today is being able to motivate and involve students in the classroom, so that they have an active role in their learning process (Felder & Brent, 2005). If students enjoy Mathematics, they are much more likely to remember what they have learned. If students are motivated to learn about a subject, they are much more likely to develop a long-term understanding of that subject (Lester, 2013). A powerful ally in this demand is the use of technologies (Skuza, 2020; Billet et al., 2022). Technologies are part of the daily lives of young people, especially those born in the late twentieth and early twenty-first centuries, the so-called "generation Z".

There are different teaching strategies such as group work, problem-based learning, classroom discussions or project-based learning, which allow the creation of active learning environments that

encourage student engagement, stimulating them to take an active role in their learning process (Dunlosky et al., 2013; Konopka et al., 2015; Caena & Redecker, 2019). The variety of teaching strategies that encompass active methodologies invest in the construction of knowledge, requiring the movement of search, criticism, study, production, autonomy and sharing among peers (Fonseca & Neto, 2017). One of the strategies that has been used with good results is the flipped classroom (Bergmann & Sams, 2012; Sohrabi & Iraj, 2016; Galindo-Dominguez, 2021). The use of the flipped classroom encourages student engagement in the learning process (Ryan, 2020), promoting understanding of the topics covered and the development of lifelong skills such as critical thinking, problem solving, creativity, initiative, autonomy, teamwork, communication and leadership (Caena & Redecker, 2019; Ryan, 2020), considered, according to the World Economic Forum (2020), some of the essential skills for 2025.

Transversal to any strategy adopted, technologies assume a prominent role when it comes to capturing the attention of students and increasing their motivation (Skuza, 2020; Billet et al., 2022), as the childhood of today's young people, generation Z, was marked by the massive use of mobile phones; by the proliferation of digital content (including video); by the emergence of social networks, blogs, chat rooms and wikis; etc.

Aware of all the above, and in an attempt to increase the commitment and engagement of her students, the first author of this work decided to reformulate the way she taught her classes, adopting the flipped classroom methodology. At the same time, and trying to strengthen the students' commitment, a continuous class assessment methodology was also used. Students were aware that any and all activities carried out in the classroom could be considered for evaluation.

The flipped classroom is a very popular pedagogical approach, in which the activities traditionally carried out in the classroom (for example, presentation of theoretical content) become homework, and the activities that normally constitute homework become classroom activities (Bergmann & Sams, 2012; Sohrabi & Iraj, 2016). This methodology is structured around the idea that lectures are not the best use of class time. Instead, the teacher provides information and makes theoretical content available before class, promoting the pre-study of theory and freeing up class time for practice.

The study here presented involved the students of Applied Statistics (1st semester of 2023/2024), a second-year course in the Marketing for Tourism bachelor's degree, offered by a higher education institution specializing in undergraduate degrees in Tourism.

2. Methodology

This study aimed to understand whether the changes introduced in Applied Statistics, adopting the flipped classroom methodology in parallel with a continuous assessment methodology, contributed to increasing the motivation and involvement of the students, namely in the Tourism area, in the learning of mathematics, in general, and, in particular, of Statistics.

Taking that into consideration, the authors developed a questionnaire for the students who attended the course under evaluation. At the end of the semester, students were asked to fill in the questionnaire. The questionnaire was distributed online to the students who attended the classes and aimed to assess the students' opinion on the changes made to the way the course was taught. After data collection, qualitative analyses were carried out, quantified whenever necessary and possible. Statistical analyses were performed with Excel.

2.1. Description of the study

In the first class of the semester, students were informed of the methodology adopted, so that they could understand their role. In an attempt to motivate them to carry out the prior autonomous study, it was stipulated that any and all activities carried out by the students, in the classroom or as homework, could count for the evaluation, with a weight of 20% in the final grade. They were also informed that they would not be previously informed of which activities would be evaluated.

Considering that there are different learning styles and different abilities, the teacher tried to diversify the tasks and resources made available. In addition to scripts with detailed explanations of the theoretical contents, detailed resolutions of exercises, tasks of a diverse nature, worksheets and tutorials, explanatory videos about the various programmatic contents were also made available. Some videos were searched on websites that offer educational resources, such as Khan Academy and YouTube, but the vast majority had been designed by the teacher during the emergency remote teaching due to Covid 19.

Students had to autonomously study, in advance, the theoretical component, either by watching the videos or by studying the scripts with the detailed explanation of the theoretical contents, of the topic that was being addressed at each moment. This study could be individual or in a group, at the discretion of each student. The aim was that when they had class they would already recognize and understand the

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study topics to a minimum, freeing up class time for more practical and interactive activities, thus allowing students to take a more active and participatory role.

In the classroom context: in the first part of the class, a summary of the theoretical contents was made and there was some space dedicated to clarifying doubts; followed by the resolution of exercises/tasks in which they had to apply the theoretical knowledge studied at home. Some of these tasks were carried out individually, others in small groups. The teacher's role was to dynamize the tasks carried out in class, to guide, to clarify doubts and to give feedback on the students' performance in the tasks developed. At the end of each class, the teacher would summarize the work done so far and give instructions on what content and materials the students should study autonomously before the next class.

2.2. Respondents

Out of the 59 students enrolled in the course, 23 attended the classes regularly. This significant difference between the number of registered students and the number of students who attended the classes is mainly due to the high number of students who were repeating the course and who, because they were enrolled in another curricular year, did not have a compatible schedule to attend the classes of this course. Of the 23 students who attended the classes, 20 responded to the questionnaire. The respondents were between 19 and 24 years old, with only one student above 21; 80% were female and 20% were male; all were attending the course for the first time and were full-time students. All the students who answered the questionnaire passed the course: 80% passed by continuous assessment and the remaining 20% by exam.

This was a convenience sample, as participants were easily accessible to researchers.

3. Results and discussion

The teacher of the course involved in this study (also one of the authors of this article) considers that the flipped classroom approach was not fully achieved because many students did not attend classes regularly and consequently did not study the materials beforehand. However, a significant number of students embraced this approach (23 out of 59).

In the questionnaire, students were asked to rate their agreement on a five-point Likert scale with various statements about the use of the flipped classroom methodology. Table 1 shows the results.

Table 1. Heatmap with frequencies of responses to questions about the flipped classroom; mean and standard deviation. (Likert scale: 1 - strong disagreement; 5 - strong agreement).

The use of the flipped classroom methodology contributed to:	1	2	3	4	5	mean	std deviation
make learning more interactive	0	0	4	8	8	4.20	0.59
make the classes more stimulating	0	0	4	11	5	4.05	0.47
involve the students in the learning process	0	0	6	8	6	4.00	0.63
a more positive view of Maths/Statistics	0	2	4	8	6	3.90	0.94
better understand the importance of Statistics	0	0	6	6	8	4.10	0.73

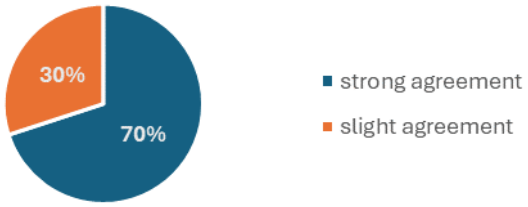
An analysis of the responses obtained (Table 1) shows that the results are quite good: students have a positive opinion about all the statements except for the statement "The use of the flipped classroom methodology contributed to a more positive view of Mathematics/Statistics", with which 2 students slightly disagree. The statement with the highest mean value is "The use of the flipped classroom methodology helped to make learning more interactive" (mean = 4.20). However, all the other statements have mean values very close to this one.

These results are in line with what the teacher could observe during the semester. Students who attended classes regularly showed commitment to both independent study and the activities carried out in the classroom. Below are some of the students' comments:

- "It's a good way to keep up with our studies."
- "[...] it was great, when it came time to study for the tests, I still knew the material that was given at the beginning of the semester."
- "I think it's a good way to involve students and 'force' them to study."

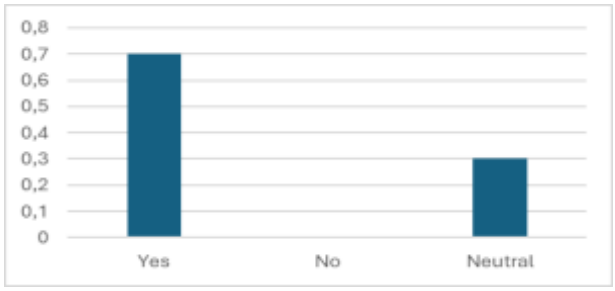
Of the various materials made available by the teacher, the videos were the most enthusiastically received by the students. All the students who answered the questionnaire stated that they considered the use of video to be relevant in the teaching-learning process and all agreed that the videos made available by the teacher facilitated keeping up with the contents (Figure 1). In their comments, they essentially highlighted the great advantage of being able to watch them as many times as they wanted, when and where they wanted, at their own pace.

Figure 1. Pie chart of opinions on whether the videos made available facilitate keeping up with the contents.



Regarding the continuous assessment methodology used in this course, all the students who answered the questionnaire, without exception, evaluated it positively and considered that it contributed to the achievement of better results. When asked if this methodology promotes motivation for keeping involved in the course, 70% gave a positive answer as shown in Figure 2.

Figure 2. Frequency chart of responses to the question: Do you consider that the continuous assessment methodology adopted in this course promotes motivation for keeping involved?



When asked what they would maintain in the planning of the course for the incoming year, the students mentioned the videos and the continuous assessment methodology adopted. Concerning what they would change, they only mentioned dividing the class into smaller groups (shifts).

4. Conclusions

The results of this project show that the adoption of the flipped classroom model together with the continuous assessment methodology adopted had a very positive impact on the students who embraced this model, increasing their involvement and commitment. Other studies show similar results on the adoption of the flipped classroom methodology (Bergmann & Sams, 2012; Sohrabi & Iraj, 2016; Galindo-Dominguez, 2021).

Regarding the limitations of this study, it is important to mention that a convenience sample was used, so the results cannot be generalized. Another limitation was the high number of students enrolled in the course, which makes it quite difficult to adopt this type of methodology. The ideal would be to have classes with a maximum of 25 students. Although many of the students did not attend the classes, there is the question of whether they did not do so precisely because there were no shifts and they considered that almost 60 students in a classroom is not beneficial.

Overall, it is the authors' belief that this study can positively contribute to disseminate new strategies that can impact students' motivation for learning, as well as the possible benefits it can have on the students' learning process.

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