STUDENTS' PERCEPTIONS OF FLIPPED CLASSROOM APPROACH – RESULTS FROM AN EDUCATIONAL INNOVATION PROJECT

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Abstract

The Flipped Classroom model is well known and recognized, and its popularity seems to keep increasing. In this pedagogical model, the transmission of conceptual knowledge is left to individual tasks outside the classroom while the contact hours, inside the classroom, are completely opened to problem solving, active and peer-assisted learning.

The purpose of this work is to describe an educational innovative experience that began in the academic year 2015-2016 with the University of Malaga's Educational Innovation Project PIE15/174 (UMA), based on Flipped Classroom and gamification in a collaborative system among its students. This project has been renewed and extended over the years, with the integration of more teachers and subjects from both the UMA and the Polytechnic University of Porto, up until the current PIE19/156. Further, the aim is to examine the degree of student satisfaction with the strategies and methodologies applied in class, paying special attention to the general aspects and the level of extension of the pedagogical model in each subject.

Some statistical analysis of students' satisfaction with the pedagogical model's application are presented. The results are promising and gratifying for all teachers involved, since these show a high degree of satisfaction with the teaching model and the strategy implementation.

Keywords: Innovation, Technology, Research Projects, Flipped Classroom; Gamification; Game-based Learning; Active Methodologies.

1 INTRODUCTION

Several teaching/learning approaches and pedagogical methodologies for Higher Education (HE) have been proposed in recent years [1]–[5]. In this context, there have been a number of studies conducted in higher education for a variety of courses that suggest that using these approaches dramatically enhanced student motivation and final grades [6]–[12]. As a result, active techniques such as the flipped classroom and gamification models have become some of the most popular options for active and cooperative learning in higher education [9], [13]. In the past few years, there has been a shift away from traditional didactic lectures toward more interactive and relevant learning environments that promote tactics that actively include students [14][15]. In 2012, Bergmann and Sams [16] designed the flipped classroom method. The movement's forerunners (chemistry teachers at Woodland Park High School in Colorado) videotaped their classes and released them online, allowing students to access them remotely, in an attempt to mitigate the consequences of students' high absenteeism rates. As a result, the core idea stems from reversing the typical teaching paradigm, which involves reversing the main phases of the teaching and learning process, such as classroom activities and assignments. The flipped classroom is structured differently: instructional content (e.g., pre-recorded video lectures) is assigned as homework (to be reviewed before class), and class time is spent working on problems, expanding concepts, and engaging in collaborative learning [17]. Furthermore, the flipped classroom may include a variety of extracurricular activities such as readings, homework, quizzes, wikis, and other additional resources besides video lectures [18]–[20].

Many studies have been conducted on the impact of the flipped classroom on students' academic achievement in a variety of areas, including English [21], [22], Economics [23], Science [24]–[26], Nursing [27]–[29], Mathematics [30]–[33], Chemistry [34]–[36], Medicine [37]–[39], Law [40], [41], among others. When compared to students who are taught using a standard teaching style, the flipped approach seems to improve students' interest in lectured topics and their participation in learning [21],

[42]. Professors who used the flipped classroom model observed that student academic performance significantly improved when compared with other classroom designs [43].

In an effort to go further in recent research, questioning the effectiveness of the flipped classroom in terms of student performance, this study will examine what occurs when this methodology is used in conjunction with game-based learning and active learning methodologies. In this particular case, the findings are based on a longitudinal study that spans the 2017/2018 academic year and continues through the 2020/2021 school year. During this time period, the opinions of 725 students from a diverse range of disciplines and degrees from universities in two countries, namely Spain and Portugal, were gathered.

Therefore, in this study, the so-called game-based learning or, more generally, gamification was directly tied to the flipped classroom model. Gamification in education is a novel application of the game design's conceptual aspects to non-ludic environments [44], [45]. In this sense, it can be regarded as a set of initiatives in the educational environment aimed at increasing students' motivation for learning, applying proposals of "gambling" experiences in formative contexts to promote a good learning environment, minimizing the cognitive effort required, and seeking greater student involvement in a competitive and cooperative climate [46]. Gamification in education tries to boost students' motivation to achieve goals by incorporating components from game mechanics into the learning system that, consequently, should lead to a shift in student behaviour as well [47]. As a result, gamification offers various benefits, including allowing students to participate more actively in their learning process, become more motivated, better grasp the topics being taught, construct their knowledge, and develop related competencies [3]. Gamification and other active techniques, according to Palomares [48], boost student enthusiasm and attentiveness, leading to better performance results and higher grades. In line with this, educators seek for tools to provide learning content in a more creative way, like Kahoot!, for example, which is extremely popular as it seems to play this role, in improving students motivation, perfectly [49]. One of the most difficult issues in today's world is keeping students interested and involved in their studies, which is why non-traditional learning methods have been used to capture students' attention. In an inverted classroom, incorporating gaming components can have a substantial impact on student learning performance, motivation, and involvement [50].

This is where the goal of this research is framed: to determine the level of student satisfaction using a flipped classroom and collaborative gamification method in an innovative didactic project. The second goal is to detect variances in student satisfaction based on the degree to which various teaching strategies are implemented. More specifically, an attempt is made to verify if there are substantial disparities in satisfaction depending on whether this educational approach is implemented completely or partially.

2   METHODOLOGY

This educational innovation experience began in the academic year 2015-2016 with the University of Malaga's (UMA) Educational Innovation Project PIE15/174. The project has been extended through PIE19/156, with the addition of more teachers and courses from both the UMA and the Polytechnic of Porto. It applies the inverted classroom educational approach to assist students in taking responsibility for their own learning. Students in higher education are expected to be managers of their time and effort, thus the project entails providing students a voice and allowing them to be the major actors in the class, which is gradually designed according to their needs and proposals. The more the learner is involved in the learning process, the more effective the learning process will be. The teachers provide the students a questionnaire to measure their level of satisfaction with the model in order to find the consequences of the project's implementation. The study of the data from this survey, as well as the academic results of students over time, has resulted in progress toward the PIEs' goals of student motivation and self-directed learning. Over time, the flipped classroom pedagogical paradigm has been implemented in several courses, and new teachers and subjects being introduced. As a result, it has not been able to fully implement this concept in all circumstances, but there have been some successes. Similarly, the wide range of degrees and subjects involved necessitates different adaptations to this methodology, resulting in two scenarios: subjects in which the teacher had at least one colleague from the same or related subject with whom to share experiences, and subjects in which the teacher was the only teacher who used this methodology and thus could not share resources or experience with other colleagues. In this group of subjects, different ICT educational techniques have been implemented, such as Kahoot!, Socrative, and other active methodologies through the Moodle platform.

- **Kahoot!** - A very useful tool, available in both a web and an App version, allows users to create quizzes and then do real-time evaluations within the class, providing feedback, the results and ranking of students, which helps to increase motivation. It is a class activity in which students in this set of courses participate to determine the degree to which they have assimilate concepts that they have learned by studying independently and through the materials provided by the teacher. The student is responsible for preparing the lesson, which is made available on the Moodle platform of the Virtual Campus. At the beginning of the next class, the teacher uses this application to create a questionnaire in order to determine the level of learning achieved by the students and to identify any potential difficulties. The students' responses to this questionnaire are included into their continuous assessment grade, making this not merely a learning tool but also an evaluation strategy.

- **Socrative** - As a learning management system, this tool provides an effective approach to monitor and evaluate learning, saving time for educators while providing entertaining and engaging interactions for students. In order to develop our activities, the Socrative tool was employed, and a bank of questions from several lessons on the syllabus was compiled and organized. Students were encouraged to participate in group activities, which included a random competition of questions and responses between the group's members.

- **Moodle platform** - In most of higher education institutions, it has been employed as an active learning tool. A free software platform is used to support blended learning, which is a concept that mixes in-person instruction with online learning opportunities. Questionnaires, chats, forums, workshops, databases, glossaries, wikis, and interactive lessons are some of the resources available to teachers and students on this virtual platform. Homework, Knowledge Test, Interactive Lesson, and a Doubts Forum are some of the Moodle technologies that are utilized in the subjects covered by this project.

In order to measure the level of satisfaction that students have had with the flipped classroom model, questionnaires have been administered to them from the very beginning of the research's deployment and during its whole evolution. These surveys were administered by the many subject matter experts, who in turn served as the study's authors. All students were of legal age of consent, and the confidentiality of the responses, as well as their usage solely for academic purposes, were assured. The so-called "non-response bias," which is one of the drawbacks of any survey-based study, was minimized since teachers encouraged and cared for students to complete the survey. An in-depth questionnaire with 13 questions was created specifically for this purpose. These questions were separated into four sections that dealt with distinct aspects of the project: adequacy, comparability, usefulness, and overall evaluation. The first block featured two questions, abbreviated Q, about the appropriateness of the materials' accessibility (Q1) and the resources employed (Q2). Two questions were included in the comparison block: one compared the usage of videos and PowerPoint presentations in the classroom to the traditional classroom (Q3), and the other compared the dynamics of the classes versus typical practical classes (Q4). With five questions in total, the third block on usefulness was the most comprehensive, consisting of the following: usefulness of the methodology in terms of not abandoning the subject (Q5), understanding the contents (Q6), improving performance (Q7), self-directed learning (Q8), and assimilating the contents (Q9). In the end, four questions were included for a general assessment, including questions about the clarity of the objectives (Q10), Kahoot! (Q11), the teacher who taught the class (Q12), and the overall dynamics of the classes (Q13). All of these questions were developed using a Likert scale ranging from 1 to 5, with 1 representing a negative opinion and 5 representing a good one. After the questionnaire was designed, the information was gathered. This occurred at the conclusion of the academic years 2017/2018, 2018/2019, 2019/2020, and 2020/2021 in a variety of courses ranging from subjects such as Accounting to subjects such as Mineralogy, among others, included in a number of degrees offered by the University of Malaga (Spain) and the Polytechnic of Porto (Portugal). Across all of them, the pedagogical approach of the flipped classroom was implemented. It was possible to collect a total of 725 useful surveys.

3   RESULTS

A general descriptive form of the findings is shown in Table 1. When looking at this table, the first thing that sticks out is that all of the answers have a mean value greater than 3.7, which is significantly higher than the average, especially considering that the maximum value is 5. This reveals how satisfied students are when a subject is taught using a flipped classroom methodology, and it helps to explain why it is so widely used in higher education.

Table 1. The most important statistical figures.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
Mean value	3.70	4.02	3.93	4.05	3.93	3.90	3.82	4.00	4.01	4.27	4.34	4.44	4.12
Standard deviation	1.40	0.81	0.99	0.93	1.01	0.99	1.01	1.00	0.83	0.75	0.86	0.81	0.78
Median value	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	4.00
Minimum value	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Maximum value	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Range	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

Source: Own elaboration

The results of a more in-depth analysis of the data reveal that the greatest values are attained in the general evaluation block. Indeed, three of the questions in this block (Q10 to Q13) are among the top-scoring questions in the whole test. In particular, when it comes to evaluating the professors, the best possible score is earned by far. In the second place, they express great appreciation for the use of Kahoot! They also express great appreciation for the clarity with which the teachers expressed what they hoped to achieve via the use of this methodology in their third-place rating (Table 1). Without going into further detail, it is once again confirmed that students are really pleased with the innovation project.

Due to the positive overall reviews, many components do not receive as high a rating. Accessibility to resources (Q1) is the lowest-rated characteristic, indicating that students have had difficulty accessing and downloading the material made available by the educators. Nevertheless, this is the feature with the highest standard deviation, indicating that not all students experienced this challenge in the same sense.

This study has demonstrated the high level of satisfaction that students experience when a subject is taught utilizing a flipped classroom, which explains why it is widely used in higher education, according to multiple studies [13], [18], [51], [52]. This instructional strategy appears to be meeting the needs of students, as evidenced by the high average score obtained across all survey questions. Most highly regarded among the headings with a high or very high degree of student pleasure and a desire to repeat the activity more frequently are those that are related to the applications Kahoot! and Trivial, which are models of gamification in learning and are employed in classrooms. This data reinforces what has previously been recognized in several research results, namely that game-based learning is one of the most effective teaching approaches to use in a flipped classroom [50][37][53][54].

4   CONCLUSIONS

In recent years, the flipped classroom methodology has become increasingly popular in higher education. Nonetheless, certain studies have recently been published that put in doubt the effectiveness of this practice in terms of improving student learning. This study was carried out with the goal of shedding more light on these uncertainties. Its main strengths include the fact that it is a longitudinal investigation with a large sample of students from various subjects and from two different countries, as well as the fact that it was conducted over a period of time. The findings of the study confirm that when the flipped classroom is used in conjunction with gamification and active methodologies, the degree of satisfaction of the students is extremely high, particularly when Kahoot! is used, and that the satisfaction level with the work of the teaching staff who uses them is also extremely high. To put it another way, this study corroborates the data that shows the benefits of using a flipped classroom. Similarly, it has been discovered that student satisfaction is slightly better when teachers who implement it do it cooperatively with other colleagues rather than alone.

These findings have a wide range of practical consequences. Obviously, utilizing these and other tools does not guarantee that the model will produce positive results. It is true that the most crucial factor is that the student feels engaged and motivated throughout the learning process. Many students do not require any additional incentive because they have already mastered the learning process, but the majority of students require more motivation and the recognition that they are an integral part of the learning process. Therefore, these findings indicate that combining the flipped classroom with gamification, such as Kahoot!, and active pedagogies can assist to boost student happiness, and as a result, its implementation is strongly encouraged in the future. Some students, however, prefer the traditional style of teaching over the flipped model because they believe that the latter requires them to

do more work on their own. One more point worth mentioning is how useful it is for teachers to use this practice in partnership with other professionals when it is feasible.

Even though the good ratings in the degree of student satisfaction allow for inferences to be drawn on their own, it would be interesting to replicate this study with the inclusion of a control group in order to compare the results obtained. Consequently, not only could satisfaction with the methodology be measured, but also student performance could be compared based on whether or not the flipped classroom was used.

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