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IMPROVING MOTIVATION IN FUTURE TEACHERS: FLIPPED CLASSROOM AND GAMIFICATION USING DIGITAL BADGES

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ABSTRACT

Aim/Purpose	This paper addresses the problem of low student engagement, motivation, and deep learning in traditional university teaching methods. It explores how integrating flipped classroom strategies and gamification through digital badges can effectively overcome some of these limitations.
Background	With the consolidation of active methodologies in higher education, supported by blended learning environments and innovative tools, the flipped classroom and gamification have gained prominence as strategies to enhance participation and self-regulated learning. Yet, their joint application in teacher training programs remains underexplored, particularly regarding their impact on digital competence development.
Methodology	The study employed a quantitative research approach, analyzing student performance data (grades, tasks completed, video viewing) and survey responses on perceptions of the teaching methods used. The research sample consisted of 63 first-year university students enrolled in an Early Childhood Education bachelor's degree at Universidad Rey Juan Carlos.
Contribution	This paper contributes to the literature by providing empirical evidence on the effectiveness of combining flipped classroom methodologies with gamification elements, specifically digital badges, in enhancing student motivation, engagement, and academic performance. It highlights how structured integration of technology-supported active learning strategies can successfully address challenges commonly associated with traditional educational methods.

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Findings	Students who participated in the flipped classroom model and earned digital badges demonstrated significantly higher academic performance compared to those who did not complete the full intervention. The flipped classroom methodology was highly accepted by students, who perceived pre-class video viewing as more effective than traditional lectures. Digital badges effectively increased student motivation and provided a clear visualization of their learning progress, encouraging higher engagement and course completion rates.
Recommendations for Practitioners	Practitioners should integrate flipped classroom approaches with gamification techniques, such as digital badges, to boost student engagement, motivation, and academic performance. Additionally, they are encouraged to develop interactive multimedia content that clearly communicates learning progress and outcomes, thereby enhancing students' active participation.
Recommendations for Researchers	Researchers are encouraged to investigate further the integration of gamification strategies, such as digital badges, within flipped classroom models to enhance student engagement and learning outcomes.
Impact on Society	The wider implications are that adopting active, technology-supported methodologies, such as flipped classrooms and gamification, in higher education can significantly improve student engagement, motivation, and learning outcomes, ultimately fostering essential digital skills among future educators and positively influencing teaching practices in broader educational contexts.
Future Research	The future goal is to develop a more comprehensive badge system designed to engage students from the outset, particularly targeting those at risk of dropping out, by assigning badges to incremental achievements, such as completing individual lessons.

Keywords	higher education, learning methods, activity learning, educational technology, computer-assisted instruction

INTRODUCTION

The European Higher Education Area (EHEA) has served as an incentive for educational innovation, with the application of new methodological practices that involve students in their learning process beyond the traditional lecture classes, taking advantage of the technology revolution (Barahona et al., 2022; Candel et al., 2024; Gil-Gómez et al., 2015; Ventosilla Sosa et al., 2021). These technologies introduced into the educational environment encourage the emergence of active methodologies focused on students, training them in skills that enable them to thrive in today's society (Gómez-García et al., 2020; Moreno Artieda & Moscoso Bernal, 2022; Pintado-Crespo et al., 2020). Along these lines, in Spain, Royal Decree 822/2021 of September 28, which regulates the organization of university education, emphasizes the use of active methodologies in the different university degrees.

One of the advantages offered by technology in the field of education is the possibility of having virtual spaces that enable more ubiquitous education, available at any time and from any location. These online spaces have been established for years in universities as blended learning, in which classroom activity is reinforced with virtual support through learning management platforms or Learning Management Systems (LMS), where the content of the subject can be shared, interacting through communication tools between students and teachers, handing in assignments and even managing grades (Singh & Scholz, 2019; Ventosilla Sosa et al., 2021; Zhou et al., 2019).

Within the active methodologies in education, focused on the learner, strategies such as the flipped classroom stand out (Barahona et al., 2022; Zainuddin, 2018; Zhou et al., 2019), and whose main idea is to offer the theoretical content to the students before each classroom session, in video or other material format, with the purpose of using the classroom to put into practice this learning (Bergmann & Sams, 2012; Hung, 2018). Innovative technologies have enabled the flipped classroom to incorporate new types of activities into its design, for example, interactive tools that have been imposed in institutions since the pandemic, such as Mentimeter or Wooclap (Pichardo et al., 2021), which have facilitated greater student participation, or the use of strategies such as gamification (Candel et al., 2024).

The acquisition of digital competencies is crucial in university teaching degrees, both personally and professionally, for their future application as teachers. It will be essential for them to be aware of new trends in technology and education (Candel et al., 2024; Moreno Artieda & Moscoso Bernal, 2022).

Traditional teaching methodologies have proven largely ineffective in addressing key challenges such as students' lack of interest, poor concentration, and the prevalence of superficial memorization over deep learning. (Barahona et al., 2022; Ventosilla Sosa et al., 2021). One solution is the application of strategies such as the flipped classroom; however, it has its drawbacks and requires proper design to ensure, for example, that students review materials before attending class (Zainuddin, 2018).

This paper is the result of research on the application of the flipped classroom approach to the subject of digital competencies in a university degree program in early childhood education. The main problems detected were poor attention during the theoretical part, insufficient time in class to complete the practical part, and a lack of digital skills, leading to a lack of motivation towards the subject. The objective of the experience was to enhance student involvement and motivation in the subject, overcoming the limitations of the flipped classroom through an instructional design that integrated technology and gamification, utilizing badges, along with a playful and attractive design that provided uniformity to the subject.

The objectives of this work are:

- To determine the impact of the applied methodology on students.
- To determine the degree of acceptance and motivation of the students in the use of the methodology.

The research is based on the following hypotheses:

H1: Students participating in the flipped classroom model with integrated digital badges perform better academically than those who do not.

H2: Flipped classroom methodology with gamification using digital badges increases student motivation.

H3: The use of digital badges helps students to visualize their progress and complete the subject.

The following sections review the pertinent literature, detail the intervention and research design, report the results, and discuss their implications for practice and future research.

LITERATURE REVIEW

This literature review presents the key theoretical foundations that support the design of the learning experience implemented in this study. Specifically, it addresses four main areas: the digital competence required of future teachers, the pedagogical foundations of gamification and game thinking, the role of digital badges as a motivational and progress-tracking tool, and the flipped classroom methodology as the core instructional strategy.

Digital Competence of the Future Teacher

The current problem is a significant lack of student interest in the subjects being taught, a lack of concentration, and a decline in learning in the digital age. Digital competences are key, which imply a set of knowledge, skills, attitudes, and strategies necessary to effectively use digital media and information and communication technologies (Alonso-Ferreiro, 2012).

To encourage the development of digital competence, various countries have proposed frameworks that organize these skills and knowledge, serving as a reference. Specifically, in Europe, there is the general DigComp Framework (Vuorikari et al., 2022) for citizenship or the European Framework for the Digital Competence of Educators DigCompEdu, which, since May 22, 2022, has been applied to teachers in Spain (BOE, 2022), called the Framework of Reference for the Digital Competence of Teachers. This is organized into six areas, divided into 22 descriptors, each of which has six stages or levels, from A1 to C2.

The relevance of digital competence in this study lies in its foundation on the Spanish national framework, which operationalizes DigCompEdu. This alignment provides theoretical coherence and ensures that the competences addressed are contextually grounded, educationally significant, and directly connected to the professional demands of future teachers.

Game Thinking and Gamification

Understanding play as the action of playing, which brings us joy and fun (Marczewski, 2018), its use is increasingly widespread in education, with various forms being applied (Borrás-Gené, 2022). Specifically, Kim (2017) and Marczewski (2018) discuss the concept of 'game thinking,' which refers to the use of games to engage users in a system and create a better user experience. Marczewski discusses five categories: playful design, gamification, simulators, serious games, and games, of which the first four can be applied in education.

To better understand this work, it will be important to delve deeper into two of these categories – playful design and gamification. Marczewski (2018) situates playful design within the broader frame of game thinking. Its purpose is to imbue any product or service with the mindset of play, curiosity, freedom to explore, and psychological safety, while deliberately avoiding the rigid rules, scores, and reward loops that typify orthodox games. Rather than grafting explicit mechanics onto a system, it draws on three game-inspired dimensions: interface metaphors, audiovisual aesthetics, and narrative framing, to create a recognizably game-like ambiance in non-game environments without turning them into fully fledged games. The second category, gamification, is defined as "the use of game design elements in non-game contexts" (Deterding et al., 2011, p. 10), by motivating participation and engagement in the classroom through the incorporation of these game techniques.

The literature on educational gamification converges on a concise set of features that reliably enhance learning: points, badges, leaderboards, challenges, levels, formative feedback, and narrative framing (Dicheva et al., 2015; Koivisto & Hamari, 2019; Subhash & Cudney, 2018). Points and badges deliver immediate, low-stakes rewards for task completion, while leaderboards add a calibrated dose of competition that allows students to gauge their standing against their peers. Challenges and levels supply graduate difficulty, guiding learners to set incremental goals and monitor their own progress. Continuous feedback then steers study habits in real-time, and even a minimalist storyline deepens immersion by creating an emotional thread throughout the material. When these elements are aligned with clear learning objectives and learners' prior knowledge, empirical evidence shows consistent gains in motivation, participation, and achievement.

In the following section, we will consider digital badges, one of the most used elements in gamification.

Digital Badges

Digital badges are visual elements in image file format with associated metadata, issued and earned after completing specific tasks or achieving set goals, and serve as rewards that recognize skills, competencies, or completed projects based on evidence (Blackburn et al., 2016; Dyer et al., 2023; Huang et al., 2019). This idea stems from its analog version, popularized by the Scout movement, where badges, earned for successfully completing different tasks, were sewn onto clothing to show achievement (Garnett & Button, 2018).

There are several approaches to discussing digital badges in education (Borrás-Gené, 2019), ranging from the perspective of gamification to motivate or involve, show progress, or incentivize desirable behaviors. In contrast, it has its use as a credential, allowing a training process to be certified in a more comprehensive manner than traditional certificates and degrees (Zhou et al., 2019). Given their characteristics, they can include information such as criteria for obtaining them, learning objectives, syllabus, or even link to evidence of the learning generated by such training. Finally, a third approach combines the previous ones, utilizing digital badges as an educational tool to guide and capture the learning process, without serving as an official certificate (Ahn et al., 2014; Jovanovic & Devedzic, 2015).

Flipped Classroom

The flipped classroom, also known as inverted classroom or flip teaching (Andía Celaya et al., 2020; Bergmann & Sams, 2012; Gómez-García et al., 2020; Talbert, 2012), is a pedagogical approach that moves the theoretical explanation time out of the classroom using various materials, dedicating classroom time to other types of activities that involve the student more actively. The teacher takes on a guiding role to help students apply the concepts previously provided (Bergmann & Sams, 2012; Cevikbas & Kaiser, 2022; Gómez-García et al., 2020; Hudson, 2019).

In the first stage of the flipped classroom, outside the classroom, students are confronted with the theoretical content. The materials are usually videos recorded by teachers (Huang et al., 2019; Zuber, 2016), although there are also options such as books, online presentations, audio files, images, news, or other types of content (Barahona et al., 2022; Candel et al., 2024; Moreno Artieda & Moscoso Bernal, 2022; Ventosilla Sosa et al., 2021). The students then become protagonists and are responsible for their own learning (Blaschke, 2012; Moreno Artieda & Moscoso Bernal, 2022), reviewing the information before attending class (Arráez Vera et al., 2018). In the second stage, in the classroom, the knowledge acquired is put into practice through activities such as problem-solving, projects, experiments, debates, and others, fostering skills like group work and critical thinking (Gómez-García et al., 2020; Nugraheni et al., 2022; Zainuddin, 2018).

Within the flipped-classroom literature, a growing body of evidence positions the gamified flipped classroom as an enhancer of the model's motivational affordances. A systematic review of 52 empirical studies published between 2018 and 2022 found that layering lightweight game mechanics, chiefly points, badges, and timed quizzes onto pre-class micro-videos, reliably raised learners' motivation, self-confidence, and preparatory effort across schooling levels, while also improving achievement in two-thirds of the cases examined (Majid et al., 2024). Complementing these results, Fernández-Velásquez et al. (2025) reported a PRISMA-guided synthesis of 37 basic-education studies (2022-2024), which showed parallel gains in autonomy, content retention, and overall satisfaction. The study highlighted the added value of narrative framing and emerging technologies, such as augmented reality, to deepen engagement. At the tertiary level, a four-month intervention with 190 pre-service teachers showed that coupling game-based videos with in-class quiz competitions within a flipped structure led to significantly higher ratings of teaching style, learning quality, and motivation, underscoring the method's viability in fully online contexts (Candel et al., 2024). Collectively, these studies suggest that when game elements are tightly aligned with competency milestones and self-determination needs, they mitigate the common compliance gaps of traditional flipped designs and translate into measurable cognitive and affective benefits.

Despite these positive outcomes, research also highlights gaps and challenges. Few studies examine the long-term, longitudinal effects of gamified flipped classrooms, and comparative analyses between disciplines remain limited (Candel et al., 2024; Fernández-Velásquez et al., 2025). Additionally, most studies originate from countries with advanced technological infrastructures and high access to digital resources, leaving a significant gap in understanding how these methodologies can be implemented in regions with limited access to technology (Candel et al., 2024; Nilubol, 2023).

In summary, the literature reviewed provides a strong foundation for the present study. Research on digital competence frameworks highlights the importance of equipping future teachers with the skills to navigate educational technologies. Studies on gamification and digital badges demonstrate their motivational potential and capacity to visualize learning progress, while evidence on flipped classroom methodology supports its effectiveness in fostering engagement and deeper learning. Drawing from these insights, our study integrates digital badges into a flipped classroom model to enhance student motivation, engagement, and academic performance.

METHODOLOGY AND METHODS

SUBJECT ANALYSIS

This research is based on the use of the Flipped Classroom and gamification, with a focus on digital badges. It was applied in the subject Computer Science and Digital Competency in the first year of the Bachelor's degree in Early Childhood Education (bilingual English) at the Universidad Rey Juan Carlos during the 2022-23 academic year. The subject is included in the university's institutional virtual classroom based on Moodle.

The aim of this eminently practical semester course is to provide students with a sufficient level of digital competence to enable them to use technology appropriately, critically, and safely. The subject is organized into four blocks: Information and Digital Literacy, Communication and Collaboration, Creation of Digital Content and Educational Computing, and Security and Troubleshooting. This structure is explicitly aligned with the Framework of Reference for the Digital Competence of Teachers (BOE, 2022), which adapts DigCompEdu to the Spanish context. Such alignment ensures that the competences addressed in the course are not only pedagogically relevant but also consistent with national standards for initial teacher education. The assessment is divided into 30% group activities, 30% individual activities in the classroom, and 40% corresponding to a final individual test.

DESIGN OF THE EXPERIENCE

The new subject design is based on practical sessions, with an initial expository part of 20 to 30 minutes, and the remainder of the time is devoted to a practical activity. To solve the problems of poor attention during the theoretical part, insufficient time in class to complete the practical activities, and a lack of digital skills that reduced students' motivation towards the subject, a strategy based on a flipped classroom was designed and applied to three of the four blocks of the subject, in a total of 10 lessons. Figure 1 shows a scheme that summarizes the design of the subject, distinguishing between two spaces: the student's home and the classroom.

The entire subject combines the flipped classroom with 'Game Thinking' by making use of two of the categories proposed by Marczewski (2018): playful design and gamification, a complete playful design based on a uniform aesthetic (Figure 2) for the whole subject, defined through a colour code according to the block and with distinctive icons for each lesson within each block in the virtual space of the subject. The aim of this graphic design has been to create a more attractive and homogeneous aesthetic for the content, similar to a game, but without being a game itself.

The design of the course (Figure 1) is structured around three key stages: activities to be completed before class, interactive and collaborative tasks during class, and consolidation and reflection after

class. This tripartite organization provides coherence between objectives, methods, and assessment. A detailed explanation of the design is given below.

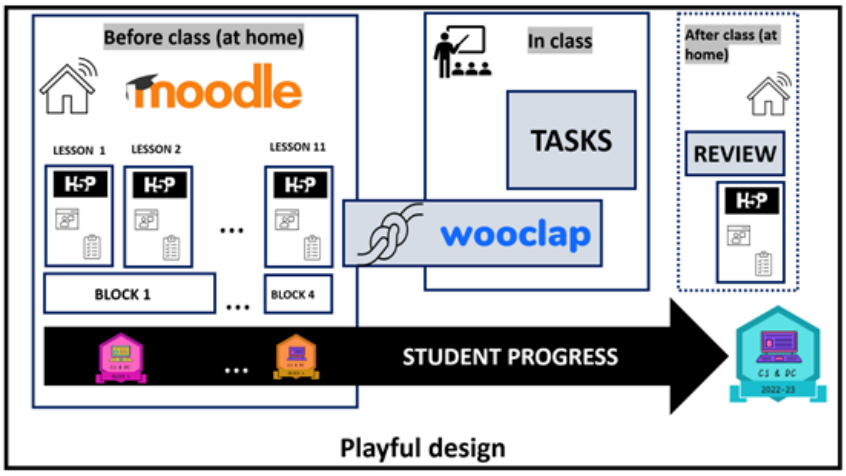

Figure 1. Design scheme of the flipped classroom experience and gamification

Figure 2. Example of subject aesthetics with icons (left) and appearance of the virtual space (right)

Before class

For this first stage, students had to review the video content before attending class. This theoretical part had a total duration of 20-25 minutes, organized in videos of 5-8 minutes in length.

The videos were integrated into the university's virtual classroom using the H5P tool, which enables multiple videos to be included in a single link, creating an interactive book associated with each lesson (Figure 3). This tool enables the disabling of navigation in the video, forcing its viewing, and allows for the addition of self-assessment questions within the video. Additionally, it provides information on which students have completed the lesson. This complete viewing was included in the assessment of the subject, with a 10% score on the final grade, only for those who viewed it before the class.

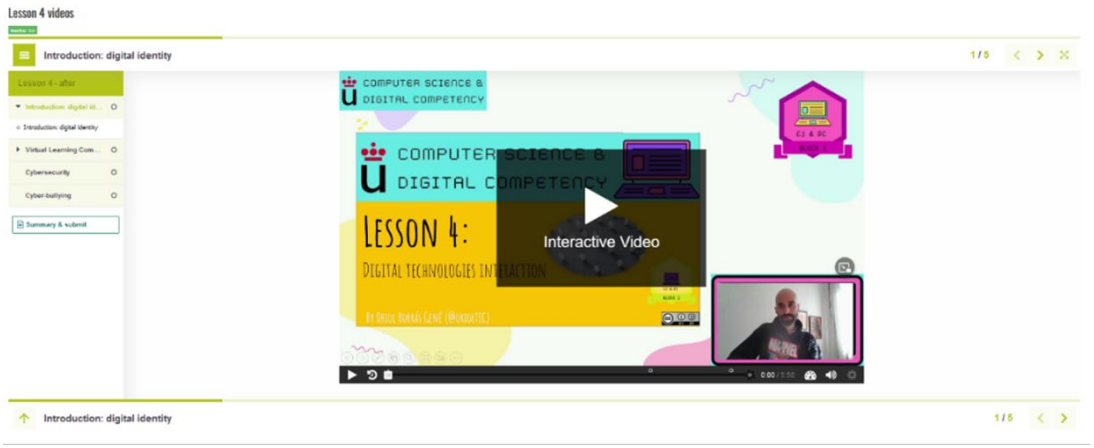

Figure 3. Example of an interactive book created with H5P

In class

At the beginning of each class, the Wooclap platform, an integrated platform within the university's virtual classroom, was used to review concepts, and students were asked questions in real-time to assess whether they had acquired the required knowledge from each lesson. During the face-to-face sessions, students were required to complete a coursework assignment and submit it at the end of the class. To complete them correctly and on time, it was necessary to have previously reviewed the content. In total, the students were required to submit 20 assignments, 11 of which employed a flipped classroom approach, while the remaining 9, which comprised the final block, were based on guided practice in class.

After class

After the classroom session, the theory videos from the first phase were re-uploaded through H5P, allowing students who had not previously viewed them or those who had not been following the course continuously to review them again. These videos in H5P were created as a new resource so that they would not be marked for assessment purposes.

Digital Badges Implemented

With the aim of assisting in the students' progress and as a motivational element, digital badges were included, one per block, making use of the tool included in Moodle for their management, automating their issuance according to a series of parameters: lessons in H5P completed before attending class and assignments handed in before the end of the class. In total, five badges (Figure 4), four for each block, were awarded only to those students who met the established criteria. A higher badge, the sum of the previous ones, was automatically awarded for obtaining all four previous badges, i.e., for completing 100% of the subject.

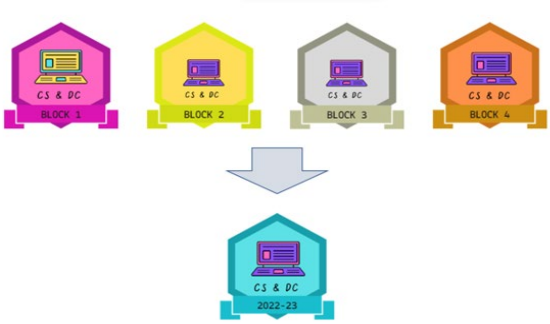

Figure 4. Digital course badge scheme

DESIGN OF THE RESEARCH

To analyze the learning experience and address the hypotheses posed in this study, multiple instruments were used to collect the necessary data. The research was conducted with the approval of the Ethics Committee at Universidad Rey Juan Carlos.

First, data provided by the Moodle platform were examined, including students' final grades and scores on specific tasks, video views tracked through H5P activities, and the digital badges earned by each student. All data were anonymized and exported in CSV format for analysis. The second instrument was an anonymous survey, adapted from previously validated and published questionnaires, consisting of 27 five-point Likert-scale items. Of these, 15 items focused on perceptions of the flipped classroom (Arráez Vera et al., 2018; Barua et al., 2014) (Appendix – Section 1), while the remaining nine addressed digital badges (Buchem & Borrás-Gené, 2020) (Appendix – Section 2). The survey was administered via Microsoft Forms and was completed voluntarily by students at the end of the course. Statistical analyses were conducted using the R statistical environment (Ripley, 2001), employing the R-Likert package (Speerschneider & Bryer, 2013). The analysis combined descriptive visualizations with inferential testing.

It is important to note that the technological tools used in the intervention did not present a barrier for students. All students receive training in Moodle at the beginning of their studies, as it is the standard platform for all courses. Additionally, during the first week of class, a 10-minute in-class demonstration was conducted to explain how to use the specific tools involved in the experience, namely, H5P and digital badges, with supporting documentation also included in the course's introductory materials. All face-to-face sessions were conducted in computer labs.

RESULTS

The total sample of students analyzed is 63. The various elements of the proposed design and its main findings are discussed below.

IMPACT OF THE METHODOLOGY ON ACADEMIC RESULTS (H1)

In the analysis of the results obtained by the students, three numerical variables are evaluated: 'final_grade' (subject grade), 'tasks and final test'. In addition, a discrete variable 'n_lessons' and a dichotomous variable 'badges' indicate whether students completed the flipped classroom path and earned all associated digital badges. The variable 'n_lessons' refers to the sets of videos for each lesson, with a total of 10. Table 1 presents a summary of the most relevant descriptive statistics for the three numerical variables.

Table 1. Most relevant descriptive metrics

Statistics	Final_grade	Tasks	Final test
n	63	65	63
Mean score	8.25	1.78	7.26
Std. Dev.	1.37	0.43	1.63
Median	8.43	1.93	7.5
Min.	2.33	0.00	2.33
Max.	9.75	2	10.00

The variable 'final_grade' (Figure 5) has a mean of 8.25 and a median of 8.43, indicating that the final grades are generally in the range of 8. The standard deviation is 1.37, showing moderate variability in the final grades.

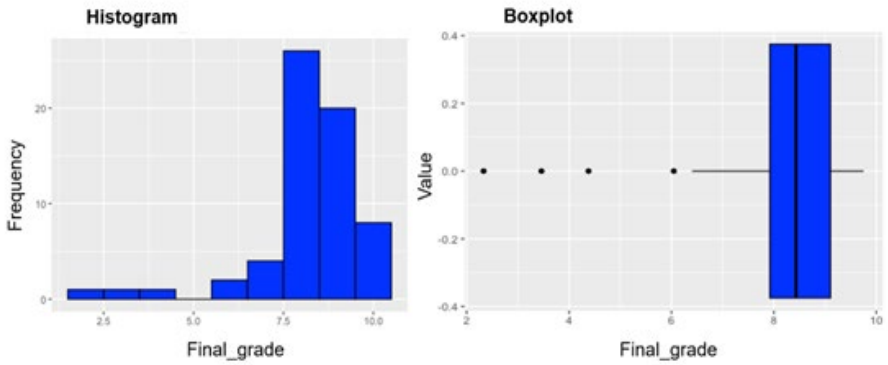

Figure 5. Histogram and box plot of the grades obtained

The variable 'tasks', the activities delivered in class, has a mean of 1.78 and a median of 1.93. The standard deviation is 0.43, indicating a relatively low variability in the mean assignments. The values range from a minimum of 0 to a maximum of 2. The histogram and box plot in Figure 6 show the relationship between the scores obtained on the tasks performed.

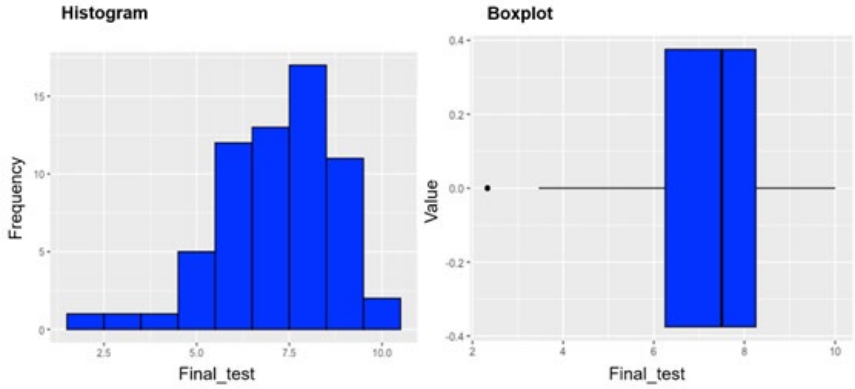

Figure 6. Histogram and box plot of tasks performed

According to the data in Figure 7, a total of 32 students have completed all the lessons, approximately 50%. Additionally, nine students have completed all nine lessons, viewing all their videos, and five students have completed eight lessons. Therefore, about 75% of the students have completed at least eight lessons. There is only a minority of students who have completed seven lessons or fewer.

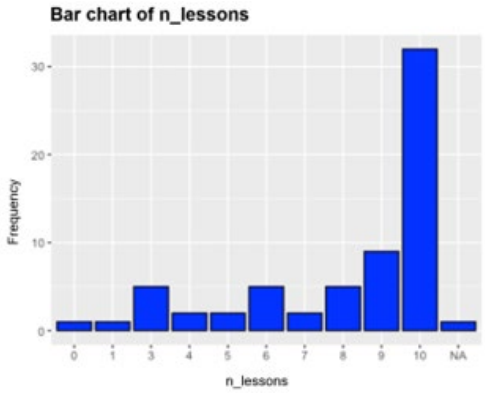

Figure 7. Distribution of the number of videos viewed

The variable 'badge' shows the distribution of students in two different categories: 'With badge' and 'Without badge'. From the data provided, 31 students have achieved badges, while 34 students have no badges. This suggests a relatively even split between those who have achieved some form of recognition (badge) and those who have not. The following box plots (Figure 8) show the distribution of the numerical variables of interest, distinguishing between two groups: students who obtained all badges and those who did not.

Figure 8. Boxplots for final grade, assignments, and final test

In the comparative analysis of final grades between students who earned badges and those who did not, a student's t-test was used. The results revealed a statistically significant difference in the means of the final grades between the two groups ($t = 4.6492$, $df = 40.128$, p-value = 3.574e-05). The null hypothesis of equality of means was rejected, indicating a substantial discrepancy in academic performance between the two sets of students. The estimate of the mean difference with a 95% confidence interval is between 0.781 and 1.982. On average, students who earned badges had a significantly higher final grade (8.95) compared to those without badges (7.57).

Similarly, when assessing task scores, a statistically significant difference was also observed between the two groups ($t = 3.4199$, $df = 33.508$, p-value = 0.001664). The mean difference estimate, with a 95% confidence interval, ranged between 0.647 and 2.545. Students with badges exhibited, on average, higher task scores (9.92), in contrast to those without badges, whose mean score was 8.32.

In the comparative analysis of final test scores between students who obtained badges and those who did not, t-tests were applied to the students' data. The results revealed a statistically significant difference in the means of the final test scores between both groups ($t = 3.8711$, $df = 60.213$, p-value = 0.0002692), with a mean difference estimate between 0.694 and 2.178. Students with badges had, on average, higher scores on the final test (7.98) compared to those without badges (6.55).

Acceptance and Motivation of Students (H2 and H3)

As can be seen in Figure 9, the survey results reveal a positive reception towards the flipped classroom learning model. Approximately 96% of the participants expressed appreciation for the opportunity to watch the videos before class, and more than 92% consider learning through videos to be more effective than classroom lectures. Furthermore, with 88%, there is a majority acceptance of the flipped classroom model. The willingness to recommend this approach to other colleagues reaches 92%.

Figure 10 shows that approximately 98% of the respondents consider the quality of the videos to be high, while 96% highlight the teacher's ability to engage them in class activities. In addition, about 88% of the participants rated the management of time to view the previous materials and the availability of these materials in the Virtual Classroom positively. Finally, 84% of respondents perceive that the activities during the class session significantly contribute to their understanding of key concepts.

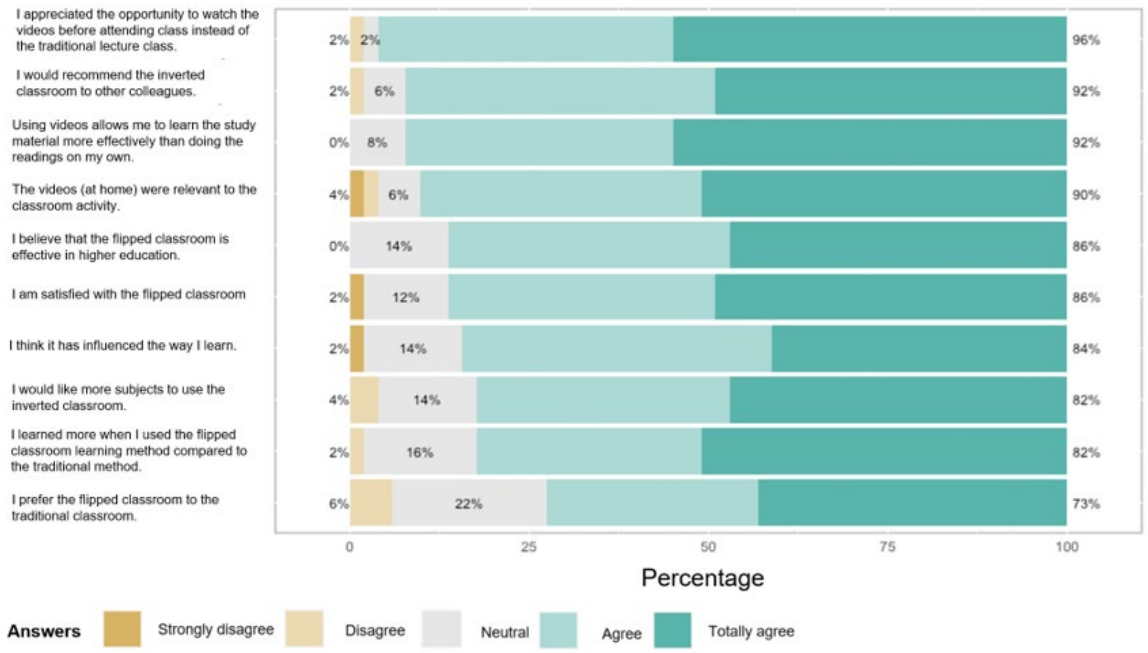

Figure 9. Methodology perception (Appendix – Section 1)

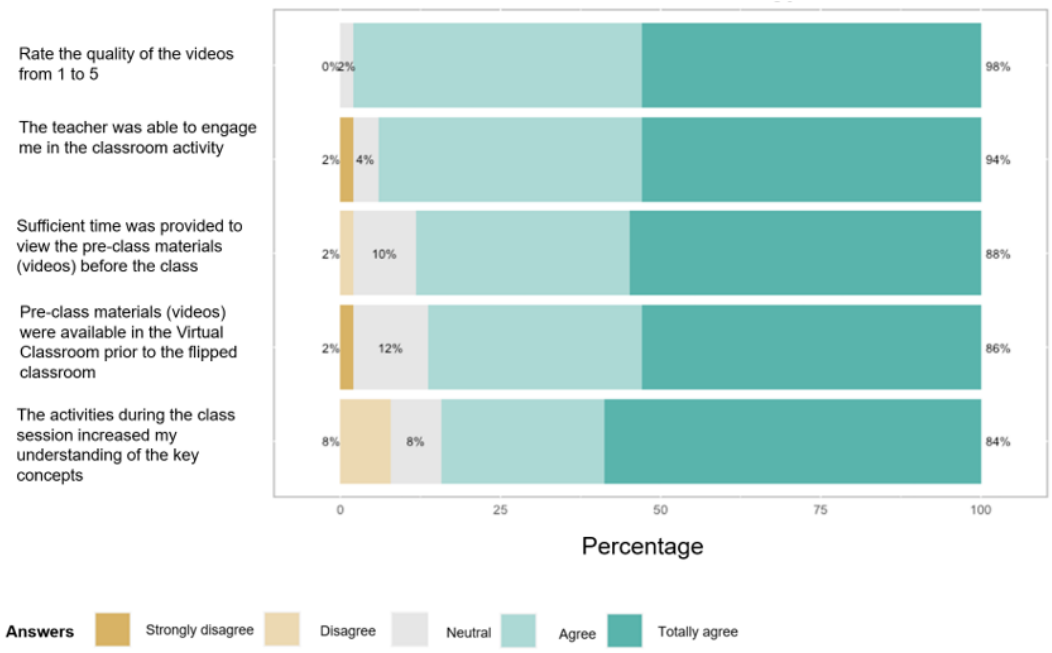

Figure 10. Commitment with the methodology (Appendix – Section 1)

In terms of perceptions of the digital badges (Figure 11), participants expressed positive evaluations of several aspects. The attractiveness of the design of the badges (76%), the usefulness for visualizing progress in the subject (74%), the consideration of their usefulness for motivating future students (74%), and the motivation generated for completing the subject (70%) stand out. There is also a positive perception of understanding the purpose of the badges (66%), the motivation to learn in the subject (64%), and the surprise of earning a digital badge (66%).

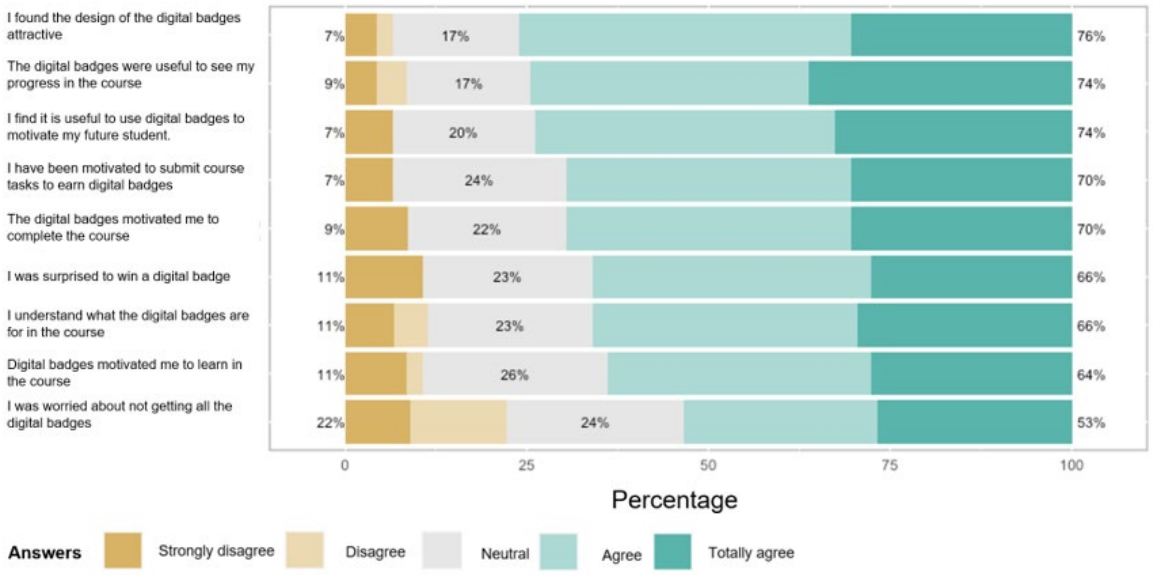

Figure 11. Digital badges (Appendix – Section 2)

DISCUSSION

The flipped classroom approach, supported by gamification strategies such as digital badges and interactive tools like H5P and Wooclap, can significantly enhance student involvement, provided these elements are embedded within a coherent instructional design aligned with clear pedagogical objectives.

The aim of this experience was to improve student involvement and motivation through an integrated flipped classroom design enriched with gamification, particularly through the use of digital badges. To this end, both the impact of the intervention applied and the students' acceptance have been analyzed.

The main contributions of this work to the training of future teachers are the design itself, the combination of two educational strategies – such as the flipped classroom and gamification – and how these have been supported by technology in their management, aiming to generate greater attractiveness. In line with important works based on the flipped classroom for training future teachers (Barahona et al., 2022; Candel et al., 2024) and other strategies such as Service Learning (Gil-Gómez et al., 2015).

In relation to the results shown in Figure 8, these suggest that earning badges is positively associated with better academic performance, supporting the idea that recognition using badges can be an effective motivator for academic achievement, confirming the H1 hypothesis: 'Students participating in the flipped classroom model with integrated digital badges perform better academically than those who do not'.

These results reinforce the positive association between badge attainment and superior performance on specific assessments, a finding that other authors, such as Fanfarelli and McDaniel (2017), have also reported. This suggests that recognition through badges can positively influence students' performance on various types of assessments, including final tests. The statistically significant difference supports the idea that badges are not only related to overall performance but can also serve as an effective motivator to improve performance on specific assessments.

The use of the H5P tool has made it possible to record student participation and improve interaction with the videos in each lesson. From the results obtained (Figure 7), a high number of completed lessons in relation to final performance stands out, indicating a high level of engagement with the course material. It also shows the influence of audiovisual content on scores and task completion. Nugraheni et al. (2022) point to the large body of research that emphasizes the influence of the prior phase of the flipped classroom on final learning success, hence the importance of good design of engaging materials.

The second hypothesis, 'Flipped classroom methodology with gamification using digital badges increases student motivation' (H2), is confirmed by a very positive attitude, with an 88% acceptance of this methodology and a favorable disposition towards its implementation as an educational strategy, with 92% recommending it to other classmates as opposed to the traditional model. Almost 100% highlighted important aspects for involving students, such as the quality of the videos, which are key to keeping them attentive, and the teacher's ability to involve them. In the face-to-face session, 84% considered that the tasks contributed to their understanding of the key concepts, where the fact of learning by doing and the possibility of receiving guidance and feedback from the teacher in real time are valued (Arráez Vera et al., 2018; Barahona et al., 2022; Candel et al., 2024; O'Flaherty & Phillips, 2015). This hypothesis is supported by 92% of respondents, who consider the use of videos to be more effective than traditional lectures.

Through the integration of digital badges in Moodle, it has been possible to add digital badges as an element of gamification, obtaining 64% of affirmative responses from students, indicating an increase in motivation towards learning the subject associated with these badges and a positive assessment of their design, with 76% of the responses.

Regarding the last hypothesis, 'The use of digital badges helps students to visualize their progress and complete the subject' (H3), the results show that badges not only helped students track their progress (74% positive responses) but also motivated them to complete the activities. These findings are consistent with prior research highlighting the dual role of badges as both motivational enhancers and visual progress indicators. For instance, Zhou et al. (2019) and Jovanovic and Devedzic (2015) emphasize that digital badges make achievement visible and tangible, helping students monitor their advancement and remain engaged with the course. Similarly, Dicheva et al. (2015) identify progress-tracking as a core benefit of gamification strategies that include badge systems.

In contrast to this work, where badges were only visible to individual students and there was no leaderboard, other experiences opt for more competitive approaches (Dyer et al., 2023). In our case, the gamification strategy intentionally avoided competitive elements such as leaderboards, focusing instead on individual progress tracking and intrinsic motivation. In line with authors such as Barahona et al. (2022), applying innovative strategies to future teachers will help them integrate these strategies into their teaching practice and develop the habit of seeking alternative solutions to present material in their classrooms, supported by a critical use of technology. Reviewing the survey results, with 74% of affirmative responses, they consider the proposed method useful for motivating their future students.

LIMITATIONS AND FUTURE WORKS

One of the main limitations of this study is the small sample size, which was limited to a single group within a single course, and the absence of a control group. A key challenge moving forward is the development of a comprehensive badge system designed to introduce students to the instructional model from the outset, with the aim of engaging those at risk of dropping out. This system would assign badges to incremental achievements, such as the completion of individual lessons. Future research will adopt a randomized controlled design, incorporate wearable sensing to measure engagement, and track the long-term effectiveness of the badge system over the course of two academic semesters. It would also be interesting to investigate different types of pre-class material.

CONCLUSIONS

The classroom offers an ideal setting for grounding theoretical content through practical application. Methodologies such as the flipped classroom, when thoughtfully designed, allow instructors to move theoretical instruction outside of traditional class time and focus in-session work on developing critical skills, such as digital competence, that are essential for future educators. When combined with complementary strategies like gamification, the overall effectiveness of these approaches can be significantly enhanced.

This study provides empirical evidence that coupling a flipped-classroom architecture with badge-based gamification significantly enhances student motivation, engagement, and academic achievement, demonstrating how a well-structured, technology-supported approach can overcome the long-standing limitations of lecture-centered instruction. Students who earned digital badges outperformed their non-badged peers, and survey data show that the cohort strongly preferred pre-class video viewing to traditional lectures. Badges not only boosted motivation but also provided learners with an immediate, visual representation of their progress, driving higher participation and completion rates. The use of technology has facilitated the management and utilization of elements such as badges, which have added an attractive factor to motivate and track the progress of each student.

Although this proposal has been applied with pre-service students, it is fully replicable in any other discipline, especially at the university level.

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APPENDIX – RESEARCH SURVEY

Participants were asked to indicate their level of agreement with the following statements using a 5-point Likert scale (1 = Strongly disagree; 5 = Totally agree).

Section 1 – Perceptions of the Flipped Classroom

1. I appreciated the opportunity to watch the videos before attending class instead of the traditional lecture class.
2. I would recommend the flipped classroom to other colleagues.
3. Using videos allows me to learn the study material more effectively than doing the readings on my own.
4. The videos (at home) were relevant to the classroom activity.
5. I believe that the flipped classroom is effective in higher education.
6. I am satisfied with the flipped classroom.
7. I think it has influenced the way I learn.
8. I would like more subjects to use the flipped classroom.
9. I learned more when I used the flipped classroom learning method compared to the traditional method.
10. I prefer the flipped classroom to the traditional classroom.
11. Rate the quality of the videos from 1 to 5. (Note: This item may have used a different scale if rating numerically; please verify in the original survey.)
12. The teacher was able to engage me in the classroom activity.
13. Sufficient time was provided to view the pre-class materials (videos) before the class.
14. Pre-class materials (videos) were available in the Virtual Classroom prior to the flipped classroom.
15. The activities during the class session increased my understanding of the key concepts.

Section 2 - Perceptions of Digital Badges

1. I found the design of the digital badges attractive.
2. The digital badges were useful to see my progress in the course.
3. I find it is useful to use digital badges to motivate my future students.
4. I have been motivated to submit course tasks to earn digital badges.
5. The digital badges motivated me to complete the course.
6. I was surprised to win a digital badge.
7. I understand what the digital badges are for in the course.

8. Digital badges motivated me to learn in the course.
9. I was worried about not getting all the digital badges.

AUTHORS

Oriol Borrás-Gené is an Associate Professor and researcher specializing in educational technology, digital competence, and technology-enhanced learning. With a strong background in computer engineering and a PhD in Education, he combines expertise from both fields to design and evaluate innovative learning environments, particularly those involving flipped classrooms, gamification, digital badges, and personal learning environments (PLEs). He currently teaches at Universidad Rey Juan Carlos (URJC), where he contributes to undergraduate and postgraduate programs, including teacher education and digital pedagogy.

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