Avatars and badges, are there differences between genders?

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***Abstract*— Gamification in higher education has become relevant to improve motivation and engagement in courses. The contribution we looked for is finding if avatar selection impacts students' performance to integrate improved gamified course design. We established a relation between the reason for avatar selection and the gained avatars to conclude its impact on motivation and engagement in two undergraduate courses, one for Calculus and the other for Professional Competencies Development. Findings point to a seek for identification with personal qualities as perseverance and discipline, and teamwork in the Calculus course. Women chose their avatar primarily based on the spirit of struggle, determination, and characteristics to overcome any situation.**

***Keywords*— Gamification, higher education, innovative education, avatars, gender.**

I. Introduction

Gamification is a widespread technique in higher education because it provides an opportunity to enhance motivation and active participation in classes. The use of avatars and leader boards contributes to a motivating class atmosphere in which students' strengths are reinforced, or at least, called to mind when they select an avatar to participate on leader boards. In addition, studies show Gamification establishes a path to recognize students' efforts and help them increase self-confidence when they have an anonymous identity that protects them from failing and being exposed. In this way, Gamification gives a chance to improve students' performance and autonomy for well-prepared graduates.

A. Gamification on higher education

Gamification results in higher education show to favor intrinsic motivation, the cognitive process, and the social aspect of learning by engaging students with their courses. For this reason, Gamification is changing the way we teach in higher education due to a lack of attention and engagement in learning [1]. In addition, Gamification is a technique that helps to increase motivation in doing academic activities and provoking active learning [2]. Moreover, studies show Gamification helps to change students' attitudes when creating a sense of belonging, competence, autonomy, and meaning [3].

Reward systems expressed as badges, points, and leader boards are the most common elements [4] widely used to motivate students to participate. Effects on practical exercises reported as influenced by gamified classes [5]. Mainly, badges are used as a recognition element represented, usually, as a visual image when students achieve some criteria or requirements [6] for a particular feature or extra effort.

Leader boards are a way to socialize given rewards [7] in which goals achieved are shown to everyone. Studies exhibit that Gamification improves motivation to do personal work, but social networking promotes collaboration and participation in the class [4]; thus, students engage and commit to better and more quality projects or products translated on grade improvements on gamified courses.

Even when studies report better results on young people when participants have previous experience with gamification [8], the background determines the success of a gamified design on education. Flow, motivation, and enjoyment are essential to gamified techniques [9].

B. Gender differences in Gamification

Over time, gender stereotypes have spread to the game, stating that men are better players than women [10], especially on video games. However, various studies have revealed that men and women like to play, but for different reasons. For example, in Rincon et al. [11], authors found that women play because they had several chances to respond correctly, which led them to reflect, while men preferred it due to its competitive nature. In the study by Warden [12], there was no difference between men and women in terms of performance when they remained in serious games. In this sense, Gamification's effectiveness depends on a set of variables, including gender [13]; therefore, an equitable and attractive gamification environment is essential for both genders, promoting active participation and developing competencies, skills, and values. The study of gender, in the first instance, encourages the inclusion of men and women since the diversity of thought is required to solve the problems that afflict the world [14].

Some studies showed no differences in Gamification demographics, but there is still room to analyze women's effect in the sense of performance recognition [15]. Therefore, this study investigates the impact on the reason or motivation to choose an avatar and gender differences.

II. Methodology

This research aims to understand why students choose their avatars and the strengths they identify with or aspire to have. There are differences between women's and men's engineering higher education classes, specifically on one math course (calculus) and one Professional Competencies Development course, to relate students' performance to gained rewards with their final grades. The leader board composed using open access or licensed images submitted by students to represent their avatar; thus, the student's identity remains anonymous.

We conducted this research on a descriptive and quasi-experimental approach to answer the defined research questions related to why students select their avatar and which are the strengths they appreciate on them. First, data collection was through online questionaries pointed to ask students why their selection and specific characteristics of their avatars. To code and analyze the information, we used the qualitative open access QCAmap on deductive mode establishing four categories: personal motivation (Q1), fictional character (Q2), an inspiring character from real life (Q3), or other (Q4). We also processed the strengths students attributed to their avatar to find the most frequent qualities and their classification as professional – performance or personal. In the second phase of this research, we related the avatar selection reason with gained rewards due to certain kinds of motivation hidden on avatars. Finally, data analysis was done using Atlas TI to get word clouds that let us stress the reasons for student's avatar selection.

We also counted and classified gained badges to correlate the number and kind of badges by gender according to their avatar selection.

A. *Population*

We did this research on two undergraduate engineering courses: Calculus and Professional Competencies Development course. For the Calculus course, the leaderboard was integrated by 44 avatars (seven women and thirty-seven men), while the professional Competencies Development course leaderboard had 15 avatars (nine women and six men).

III. Results

Results showed 60.47% of men on the Calculus course, compared to 25.58% of women, selected their avatar based on fictional characters (mainly superheroes) because they found personal attributes on the way characters face difficult situations in life, not just professional. On the other hand, 31.58% of women selected their avatar for personal reasons, while 23.53% men students on the Competencies Development course. Table I shows these results on choosing avatar on both courses.

TABLE I. Avatar Selection by course and gender

Gender and course	Classification of avatar selection			
	Q1	*Q2*	*Q3*	*Q4*
Women Calculus course	28.57%	6.98%	0%	4.56 %
Men Calculus course	20.93%	60.47%	18.60%	0 %
Women Competencies development course	33.33%	19.60%	0 %	0 %
Men Competencies development course	37.50%	6.98%	2.33%	2.33 %

Differences on the table I show students on both courses preferred an avatar because of personal preferences (Q1) and fictional characters (Q2) which whom they identified. There are no relevant differences between genders on this point, but there is a stressed preference on Calculus men who selected an avatar according to a fictional character (Q2).

A. *Calculus course*

In the Calculus course, 44 students participated, of which 7 were women and 37 men; from this moment, we can see a significant difference in both genders despite population distribution. Four women selected a superhero as a character, two an animal, and one a happy face. Figure 1 shows the reasons why women decided on their avatar on this course.

It is striking that women identify their avatar with the spirit of struggle and perseverance. We can think of it because even though the engineering field could be challenging for the female gender [16], they are willing to fight to persevere to achieve their academic and professional goals.

Fig. 1. Qualities that women in engineering identify within their avatar.

Regarding men, 25 selected superheroes, 5 chose animals, 4 chose athletes, two cartoon characters, and one selected one object. Figure 2 shows the reasons why men decided on their avatar.

Fig. 2. Qualities that men in engineering identify within their avatar.

In men's case, as with women, the quality they identified with their avatar was perseverance, and it is striking that helping others emerged repeatedly. In this sense, we see that both men and women, through their responses, showed enthusiasm in selecting their avatar, reflecting that both genders like to get involved in the game, but for different reasons [17].

On the other hand, Table II shows the number of badges won by students by gender in the Calculus course.

In both genders, badges related to the competition were the most frequent, followed by discipline and teamwork, on both genders. Those related to the battle were those in which students had to answer challenging questions. The badge related to collaborative work recognized teams that showed the best performance; the discipline badge recognized the attendance and the best activities carried out individually.

TABLE II. Number of badges won by type and gender on Calculus Course

Badge type	*Women*	*Men*
Competition	112	315
Teamwork	16	48
Help others	2	4
Discipline	20	49
Progress	11	36
Total	161	452

Additionally, figure 3 shows the final grades for this course. Although we had few women compared to men students, both have a normal distribution with 5% on an Anderson-Darling test.

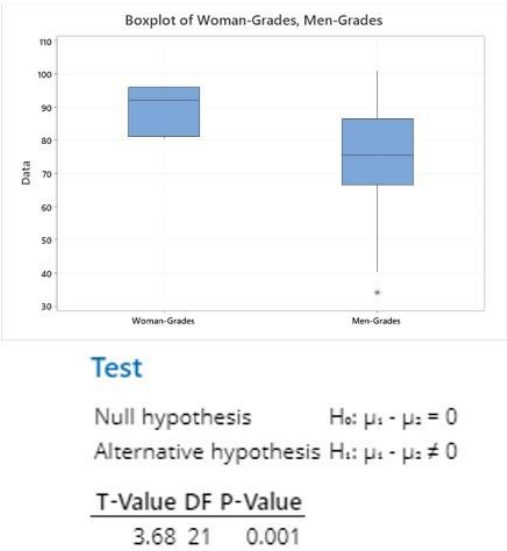

Fig. 3. Final grades boxplot and t-test of Calculus course.

Results expose that even though students of both genders chose an avatar that represents perseverance, women had higher grades than men. However, their grades were homogeneous compared to men's grades (women mean= 89.1, men mean= 75.2). Furthermore, T-test shows a significant difference (α=0.05, Fig. 3).

B. Competencies development course

In the Competencies Development course, 15 students participated, of which 9 were women and six men. Differences in this course avatar selection were on the kind of avatar they selected. For example, only one women student chose a superhero, while five chose a Disney character, mainly princesses. Men on this course chose fiction characters from cartoons, movies, or anime. Only one of them decided on a real-life person who he admires. Figure 4 shows the reasons why women selected their avatar on this course.

Women referred to their avatar as a personality recognition and desire to overcome any situation by personal strengths they see on Disney's movies characters when the main character must act on a specific and challenging situation. They also identified their avatar with childhood or even comfort. This finding is an important issue due to competencies development, and their character for employability [18] must remind the best. Students are looking for personality attributes that enable them to improve their performance as professionals beyond personal life.

Fig. 4. Qualities that women in the Competencies Development course identify within their avatar.

Figure 5 shows the men's selection for their avatar. They also based their choice on personality but also character qualities. Men seem to be looking for appropriate and professional performance through their skills in doing their best.

Fig. 5. Qualities that men in the Competencies Development course identify within their avatar.

Avatar selection is similar on this course mainly because students are looking to be the best candidate for employability skills. In addition, students are aware of the need to develop soft and hard skills and the relevance of these competencies for their professional success in the labor market [19]. Table III represents badges won by women and men on this course and the idea of being the best on employee performance.

TABLE III. NUMBER OF BADGES WON BY TYPE AND GENDER ON COMPETENCIES DEVELOPMENT COURSE

Badge type	*Women*	*Men*
Performance	18	9
Competition	3	5
Personal skills	10	4
Total	31	18

On this course, performance badges were the most gained on both genders, due to course characteristics in which individual work was more frequent than teamwork and badges assignation. Competency development is personal and referred to as performance instead of competition [20]. In any case, personal skills [21], which included perseverance and attendance, are an element of competencies expressed independently. These results allow us to tell competencies

were developed, as expected, during the course. Gamification helped not only to use the competencies but also to confirm its development.

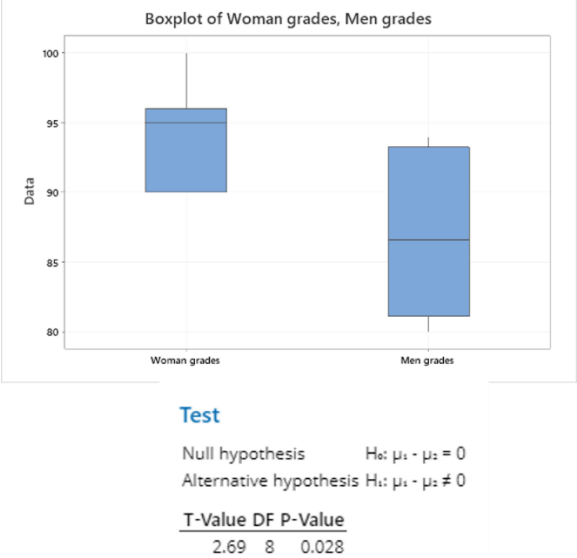

Fig. 6. Final grades boxplot and t-test of Competencies Development course.

Final grades endorse performance on both courses. On the Competencies Development course, students who got more than two badges had a final grade in the range from 93 to 100 (on a scale from 0 to 100), in contrast with students who got zero badges with final grades from 76 to 100. Fig. 6 shows a significant difference in women's and men's final grades (women mean= 95, men mean=86.7) for students with an avatar on the leader board.

Moreover, we can tell, Gamification contributes to course objectives in both courses. Avatars represented students' desires and motivation to succeed in their practice as a personal achievement. Students avatars' inspiration promotes better performance in some cases.

It is essential to mention that these two gamified courses are using Gamification as an alternative to increasing student engagement. These gamified courses intend to attract students instead of building a process in which students are supposed to play as part of the course and learn about fun and motivation [22]. In these two courses, Gamification is supporting to engage students and motivate them to participate. Students are awarded when they complete a specific task in specific circumstances or have outstanding participation according to given instructions.

Avatars classification on four reasons threw the more considerable amount of won badges was for Q2 (Table IV), that corresponds to fiction character (superhero or any other). Forty students who chose their Avatar for Q2 obtained two hundred seventy-eight badges (251 on Calculus and 27 on Competencies Development course). Reason Q1 (personal motivation) was the second place for won badges. These numbers reaffirm the election based on unique qualities focused on performance, perseverance, and personality, even when considering women's population is smaller than men on engineering courses, which represents a limitation on this study. Therefore, women empowerment is a reason to understand how students chose their avatar and analyze won badges.

In table IV, we have the chance to set some correspondence on the number of students who won badges according to the avatar selection. Classification "other" (Q4) was the one with fewer badges won, Q1 and Q3 represent an inspirational representation or aspiration, they had the third and second place. In contrast, Q4 (a fictional character, mostly superheroes) had the highest number of given badges. These results support our findings on the relevance of choosing an avatar and how the avatar represents their desires to succeed and have a better performance.

TABLE IV. TOP 5 WON BADGES ON BOTH COURSES ACCORDING TO AVATAR CATEGORIZATION

Gender and course	**Classification of avatar selection**							
	Q1		***Q2***		***Q3***		***Q4***	
	Badges	***Number of students***	***Badges***	***Number of students***	***Badges***	***Number of students***	***Badges***	***Number of students***
Women Calculus course	41	2	7	4	0	0	0	0
Men Calculus course	133	9	244	26	147	8	23	2
Women Competencies development course	16	4	25	8	0	0	0	0
Men Competencies development course	6	3	2	2	0	0	1	1

Gamified designs are more relevant and valuable on learning motivation instead of teacher's perspective [23] considering these outcomes for students' motivators beyond stereotypes. A benefit of aligning gamified designs to avatar selection's reason is to enhance the reward system to interest students and improve their motivation to active participation and engagement on gamified courses.

Dicheva et al. [24] mentioned three elements to consider in designing; the most important is freedom of choice and personalization. This consideration can be by integrating avatars into the gamified design causing learning objectives achievement with enjoyment.

IV. CONCLUSIONS

According to studies and results from these two undergraduate courses, creating the experience of learning through Gamification is a viable option. Students need an incentive to get involved in their classes, and Gamification is an excellent excuse to enhance course designs. It will be essential to integrate these findings into gamified strategies to get the most relevant and engaging gamified course and integrate digital and dynamic leader boards.

Besides the freedom to select avatars depending on personal preferences, learning becomes enjoyable when there is a sense of belonging and authorship from students when they know they are considered and recognized as part of the course. These are reasons for gamified designs considering not only learning objectives but students' preferences.

Avatar selection showed a close relation to setting an avatar because of the qualities students identify on the character and their needs on both genders. For example, Calculus women students expressed, in some way, their

interest in overcoming any problematic situation in engineering as well as participating in teamwork. In contrast, students on the other course seek the development of competencies they need as professionals. Results do not seem different by gender, but students look forward to increasing self-confidence and performance through their avatars. We cannot deny the fact that the women population is lower in engineering courses compared to men. Still, women's participation in sciences is a relevant topic today.

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Competencia o aspecto a reconocer	Descripción didáctica	Narrativa genérica	Narrativa de súperpoderes
Participación destacada	-Recuperar conocimientos previos a través de la participación de los estudiantes. -Motivar la atención de los estudiantes a través de preguntas sobre el tema que se está abordando.		
Pensamiento crítico	Reconocer cuando el estudiante hace uso del pensamiento crítico en la solución de problemas, propuestas o juicios.		
Desempeño destacado	Reconocer al estudiante cuando obtiene una buena calificación en exámenes, proyectos o tareas, según decida el profesor		
Trabajo colaborativo	Reconocer cuando el trabajo colaborativo es destacado.		
Resilencia	Reconocer la perseverancia del estudiante respecto a la mejora de su desempeño o en sostener su buen desempeño		
Empatía	Reconocer cuando un estudiante ayuda a otro compañero o al profesor de manera natural y desinteresada		
Competencia digital	Reconocer el desempeño destacado en el uso tecnología para resolver problemas, presentar un proyecto, desarrollar un proyecto, etc.		
Responsabilidad	Reconocer la puntualidad y asistencia de los estudiantes/ Tener la cámara encendida durante la clase.		

Gamification during Covid-19: Promoting active learning and motivation in higher education

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Virtual teaching modalities urgently implemented during the Covid-19 pandemic require strategies to motivate students to participate actively in higher education. Our study found that gamification using a reward-based system is a strategy that can improve the educational experience under exceptional circumstances. This article reports the results of two gamified undergraduate courses (Calculus and Development of Transversal Competencies) designed with a reward system. The results derived from analyses of online surveys, the final grades, and their correlations revealed that gamification helped motivate students to participate actively and improved their academic performance, in a setting where the mode of instruction was remote, synchronous, and online. From the results we conclude that gamification favours the relationship between attention, participation, and performance, while promoting the humanisation of virtual environments created during academic confinement.

Implications for practice or policy:

- Gamification using a reward-based system promoted active class participation and improved student performance after the transition from face-to-face to virtual instruction required as a result of the global pandemic.
- Systemic recognition in a reward-based system improved the participants' emotional states, reducing their anxiety and the feeling of isolation caused by the pandemic, and leading to student engagement with .
- Gamification works as an accompaniment for students to help the increasement of teacher-student and student-student interactions.

Keywords: gamification, game rewards, motivation, innovative education, academic confinement

Introduction

The Covid-19 pandemic has caused terrible damage worldwide, not only to people's health but also to economies, politics, and society (Arnove, 2020). This situation impacted universities as some countries closed facilities, forcing instruction to migrate to the online mode almost overnight. The abrupt changes caused by the pandemic have significantly affected students at all educational levels. Under these circumstances, educators must develop the best educational environments for meaningful learning to remedy the academic lag from the Covid-19 pandemic (American Psychological Association [APA], 2020; Daniel, 2020). With this in mind, we transferred the gamification strategy used in our face-to-face instructional modality to a synchronous online environment using the Zoom platform. The purpose of this article is to show how gamification with a reward-based system has played an essential role during the Covid-19 pandemic to attract student attention, engagement, and motivation in the teaching-learning process. Additionally, without knowing when and how students and teachers will return to the classroom, we developed this proposal as an alternative for teachers and researchers who seek to improve students' well-being as they take their courses.

Literature review

Gamification for active learning

Recent educational trends reveal that educators favour active learning, where the student is the center of the learning process (Tharayil et al., 2018). Thus, several studies argue that active learning moves students from memorisation to a more meaningful learning experience (Aji & Khan, 2019). Freeman et al. (2014) show that students exposed to active learning have less risk of failing or dropping out than students who take classes under traditional instruction. Students tend to get better grades when teachers avoid

distractions, set clear learning goals, and provide opportunities for interaction in safe spaces for students to ask questions (Lagubeau et al., 2019). Although designed to improve learning, teaching methodologies alone, such as problem-based learning, collaborative learning, and project-based learning (Davis & McPartland, 2012), do not end apathy, lack of commitment, and the inattention of students (Gomez-Chacón, 2000; Rincon-Flores, Lopez-Camacho et al., 2020). The intended improvements must align with methodologies that involve students' engagement to educational strategies (Rojas-López et al., 2019).

According to Hamari et al. (2016), immersing students in activities promotes their engagement with learning. For other authors (Gruman et al., 2010; Looyestyn et al., 2017), commitment (engagement) is the amount of energy applied to actions and tasks' completion. Skinner and Belmont (1993) define engagement as the passion for developing and completing assigned learning activities. In other words, positive impulses drive the accomplishment of a task.

Moreover, students can have three types of participation: behavioural, cognitive, and emotional (Fredricks et al., 2004). Behavioural participation in a class results from the student's positive attitude. Cognitive participation involves the willingness to think and understand a topic or concept. It requires self-regulation (Deci & Ryan, 2008). Finally, with emotional participation, the student reacts to the feelings experienced in class. Emotional participation displays are happiness, apathy, anxiety, interest, or boredom.

In the 1990s, Csikszentmihalyi (1990) developed the flow theory, where the student is absorbed by doing some activity that they enjoy. Using this approach, Csikszentmihalyi found that people immersed in activity experience joy and a sense of success (Admiraal et al., 2011). Therefore, this flow leads to engagement with learning and a positive learning experience (Hamari & Koivisto, 2015; Hou & Li, 2014; Sailer et al., 2017; Tsai et al., 2016). Attention is the ability to stay focused on an object or thought for a specified period (Korving et al., 2016). Posner et al. (1980) describe three attention processes: alertness, spatial orientation, and executive attention. In an adult, achieving an efficient state of attention implies developing and coordinating perceptions, strengthening neural connections, and interacting supported by memory processes (Amso & Scerif, 2015). Through didactic strategies, it is possible to trigger commitment. Additionally, well-managed steadfastness and flow can drive intrinsic or extrinsic motivation, which correlates with autonomy and external regulation (Alsawaier, 2018; Deci & Ryan, 2008; Topîrceanu, 2017). Our reflections on the gamification strategy we employed align with these ideas. When developing a class, gamification is an effective educational strategy to promote student attention and engagement.

Gamification also enhances active learning. Studies worldwide show that gamification is a strategy to increase student participation (Borras-Gene et al., 2016; Freudmann & Bakamitsos, 2014; Hamari & Koivisto, 2015; Kyewski & Krämer, 2018). It is used in business (Herzig et al., 2015; Robson et al., 2015; Saputro et al., 2019), government (Hassan & Hamari, 2020), health (Buchem et al., 2015; Garett & Young, 2019; Magaña-Valladares et al., 2018), and education (Domínguez et al., 2013; Hanus & Fox, 2015; Rincon-Flores, Mena et al., 2020; Rojas-López & Rincon-Flores, 2018; Santos-Guevara & Rincon-Flores, 2020). Gamification employs game elements in contexts that are not typically games (Deterding, 2015) to boost intrinsic and extrinsic motivation in various ways. Extrinsic motivation can result from a reward system, while challenges produce intrinsic motivation (Rincon-Flores et al., 2018; Rojas-López et al., 2019; Surendeleg et al., 2014). Thus, game elements and experiences designed in the learning methodologies in any field of study define gamification. The student also develops transversal competencies and attitudes through gamification, such as collaboration, self-regulated learning, and creativity (Caponeto et al., 2014; Dichev & Dicheva, 2017). In gamified learning, rules, emotions, and social roles are part of the experience (Lee & Hammer, 2011) and are essential aspects of the educational process.

Rewards for the win!

While self-regulation theory explains the correlations of intrinsic motivation, autonomy, competence, and socialisation (Deci & Ryan, 2008), extrinsic motivation defines external regulation, introspection, identification, and integration (Topîrceanu, 2017). Engagement and flow influence motivation, both, intrinsic and extrinsic, since behavioral changes are triggered when various educational strategies are designed to generate commitment (Alsawaier, 2018). Therefore, reward-based systems in gamified classes play a vital role in player motivation to act and become engaged with learning (Rodríguez & Santiago, 2015; Werbach & Hunter, 2012). Reward-based systems are designed to recognise participants' achievements through tangible or virtual goods, for example, Starbucks' accumulated stars that customers

can exchange for prizes (Xin et al., 2018). Thus, participants seek a benefit after completing a specific task or activity because they are motivated by a tangible gift, treat, or competition (Frost et al., 2015; Park et al., 2019). The rewards or changes in the participants' attitudes (Zimmerling et al., 2019) can be internally satisfying (intrinsic motivation) or practical (extrinsic motivation) (Morschheuser et al., 2019).

In this research, understanding that rewards motivate students to participate, we created a reward system within a gamification resource. We determined the appropriate award timing, the type of reward, and the method to obtain it (Kwiatek & Thanasi-Boce, 2019). According to Schöbel and Söllner (2014), there are four types of rewards: individual, collaborative, competitive, and competitive-collaborative. Thus, a person may be motivated by a sense of autonomy, a relationship, or achievement of a competency (Frost et al., 2015), emphasising the relevance of the game narrative (Iain et al., 2019).

The type of reward most used in gamification is the collaborative-competitive type (Schöbel & Söllner, 2014), where it is possible to accumulate points through specific incentives or reward structures (Zimmerling et al., 2019). A tangible reward is the most inspiring motive for some users, while a real but achievable challenge is more satisfying for others (Heninger et al., 2019). However, rewards are not the only motivator. All the experiences involved in gamification are motivating.

Furthermore, motivational factors can be classified into three categories, identifiable achievement, social interaction, and immersion (Smeddinck et al., 2019), which all determine a player's level of participation. This classification gives a feeling of progress and better (mechanical) performance since it is a challenge that involves socialisation. The timing of the reward plays a significant role in the intensity of extrinsic motivation (Plangger et al., 2019).

Under behaviour theory, the participant's motivation depends on the type of incentives and the frequency of obtaining rewards, whether tangible or intangible (Smeddinck et al., 2019). The rewards granted, consider progress and expected or desired behaviour. All these affect intrinsic motivation. According to the self-determination theory (Lefers & Birkenkrahe, 2016), external motivation becomes a factor that increases internal motivation, and vice versa. We can also say that motivation is transformed into action when the participants accept being part of the game's dynamics and mechanics to demonstrate their ability, autonomy, relationship, and competence in an environment conducive to quality learning (Frost et al., 2015).

In education, one of the representative mechanisms of gamification is the leaderboard, that shows each participating member's scores (Jin et al., 2016). The leaderboard and avatars exemplify the dynamic way in which participants choose an anonymous identity for their achievements, the relationship and competency factors, seen as a motivational requirement (Smeddink et al., 2019). However, Kocadere and Çağlar (2018) argue that the leaderboard's purpose is to motivate the *killer* players, while the badges motivate the *winners*. Unlocking content in a game (moving to the next level, for example) corresponds to *explorers*, while both gifts and teamwork attract *socialisers*. Therefore, an effective reward system must incentivise different types of players according to their classifications.

Gamification offers an opportunity for broad participation and enjoyment of the learning experience (Tan & Hew, 2016) because it can be developed as a phone app (Wu, 2018) or for the online computer, thus, attractively changing the students´ flow (Laato et al., 2020). Gamification combines content, technology, and interaction while facilitating remote distance learning (Observatory on Educational Innovation, 2020). The gamification proposal of this study is summarised in Figure 1.

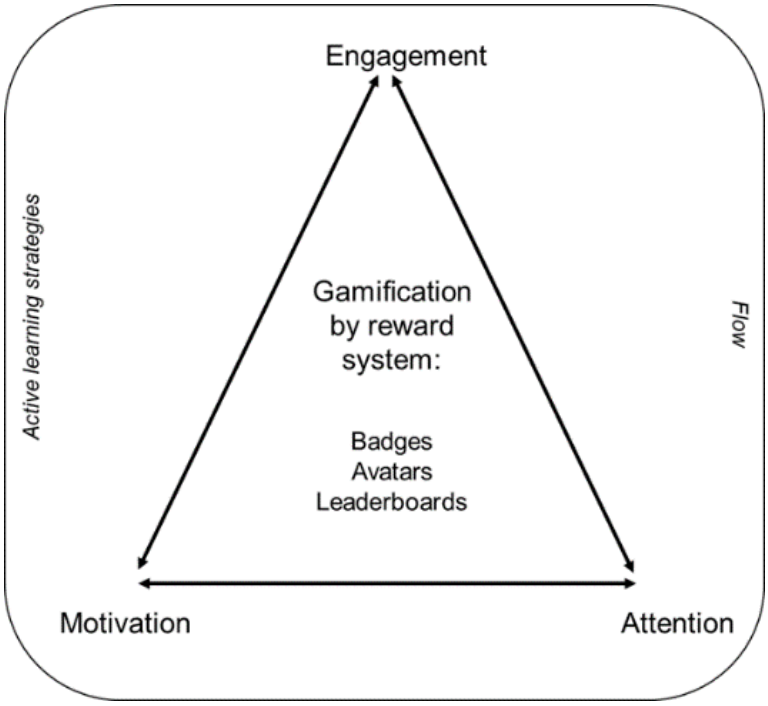

Figure 1. Gamification model applied

The gamification model that we proposed in this study was based on a reward system that included badges, avatars, and a leaderboard designed to promote the attention, motivation, and continuous engagement of students in an active learning scenario that maintained the flow to get the best performance, even beyond grades, applied in a context of academic confinement. It is important to note that this model can be replicated in various disciplines and learning environments.

Methods and procedures

Description of the reward system

During the spring semester (February to June 2020), we applied gamification in Calculus for Engineering and Development of Transversal Competencies, two undergraduate courses at Tecnologico de Monterrey. In the first subject, we made a narrative of superheroes to recognise knowledge, attitudes, and values that fundamentally comprise the integral development of our university graduates. For this course, six math badges were enabled for earning points that could be redeemed in each evaluation period (every 5 weeks), up to a maximum of 10 points. If a student accumulated more than 10 points, these could be saved for the next evaluation period. Each badge corresponded to a different number of redemption points. Table 1 shows the reward system.

Table 1
Description of the "Superpowers" reward system

Badge of power	Description	Points
	Undergraduates earned the Flash badge when they answered a challenging quick-response question. The goal was to attract the attention of the class.	1
	Undergraduates earned the Stark badge when they answered a more challenging question or placed first in a Kahoot.	2
	The Captain America badge recognised students who performed their activities on time, well prepared, and correctly. The goal was to acknowledge positive attitudes.	1

	Spider badge recognised students' progress, for example, when they improved in a second assessment.	1
	Groot badge recognised values, for example, when the teacher noticed that the student helped other classmates.	1
	The Fantastic Four badge recognised students' collaborative work.	1
	Thanos badge eliminates the badges won in an evaluation period.Its objective is to punish an academic failure or a disrespectful attitude with their peers or teacher.	

Instead of taking class attendance (because connectivity issues inevitably occur in online instruction), we decided to recognise the assigned activities' content, presentation, and punctuality. Likewise, we decided to increase the number of questions to encourage participation and attention in synchronous classes (Flash and Stark badges) and more collaborative work, recognising the teams' performance (Fantastic Four badge). To participate in the reward system, the students selected an avatar to represent them, an image displayed on the leaderboard that was updated weekly. The avatar also had the purpose of hiding the students' identities to respect their privacy, only the teachers knew the identity of the participants. Figure 2 shows a partial image of one course leaderboard where we applied the reward system.

Figure 2. Partial image of the leaderboard

The reward system in the Development of Transversal Competencies course operated similarly to the Calculus course, the only difference being that the former seeks to prepare students for an internship, so its syllabus explained the recruitment processes and products, such as resume, interview preparation, and LinkedIn profile, among others. Students willing to participate submitted their avatars for anonymous display on the leaderboard. Seven different badges corresponded to specific course assignments (Table 2). This course had an outdoor challenge activity, named TecChallenge, in which students could get three kinds of badges through group voting (resilience, audacity, and realisation). During the pandemic, this activity was virtual, but it maintained the spirit of challenge and teamwork. The teacher assigned the other badges

according to pre-established instructions and requirements. For example, for the Victory badge, students had to be in the first three positions on the LinkedIn group profile ranking, while the Networking badge needed evidence of contacting ex-alumni to increase their LinkedIn network. Perseverance was assigned to students who attended their classes and completed all the assignments. For this course, each badge represented 2 extra points toward the final grade on a scale from 0 to 100.

Table 2
Badge descriptions for the Development of Transversal Competencies course

Badge	Description	Points
	The Victory badge represented a triumph. It might be awarded for having accumulated the most points or outstanding performance in Resume, LinkedIn 1, and LinkedIn 2.	2
	Effective Communication badge was awarded when communication was successful during the elevator pitch, email, and mock interview activities.	2
	Networking badge was awarded when the student managed to increase their network.	2
	Resilience badge was awarded when students participated in collaborative activities with classmates. This badge could also be awarded in the mock interview.	2
	Realisation badge was awarded when students showed their hidden skills during the Tec Challenge.	2
	Audacity badge recognised when the student proposed and carried out unusual activities to solve challenges if they did not put their integrity and classmates at risk.	2
	Perseverance badge recognised class attendance and completion of all the course assignments.	2

The leaderboard for this course was similar to the one shown in Figure 2. Participation in the reward system was voluntary. Those who decided not to participate were not affected. If students wanted to join later, they could do so at any time during the course.

Research questions

In this research, we used a mixed (Creswell, 2007; Creswell et al., 2003) and correlational methodological approach, where the qualitative results complemented the quantitative results. The following research questions guided us:

(1) To what extent did gamification with a reward-based system motivate students during academic confinement due to COVID-19?
(2) To what extent did gamification with a reward-based system improve students' attention and active participation during academic confinement due to COVID-19?
(3) To what extent did gamification with a reward-based system improve students' performance during academic confinement due to COVID-19?

We administered a Likert-type scale questionnaire (4 points) to the students in each course to answer the first research question. The questionnaire aslo included some open-ended questions that students voluntarily answered. Likewise, we administered a questionnaire with a Likert-type scale for the second research question, including some open questions. We established a correlation between the final grade with the number of badges that each student obtained. For this purpose, only the attention and active participation badges were used (Flash and Stark badges). For the third research question, we calculated the

correlation between the total number of badges earned by students and their grades. In addition, we reviewed the results of the institutional evaluations of teachers' performances during the global pandemic.

The sample

The sample consisted of 57 students, 40 enrolled in Calculus and 17 in Development of Transversal Competencies. The ages of the undergraduate students ranged from 19 to 21 years old. Most were from different cities in Mexico and some from other Latin American countries.

Research and analysis phases

Figure 3 shows the research phases and the instruments and data collection techniques used. We implemented the rewards system during the academic semester, February to June 2020. At the end of each course, we applied a questionnaire with a Likert-type scale. This instrument also included some open questions about the impression that gamification made on the students in each course.

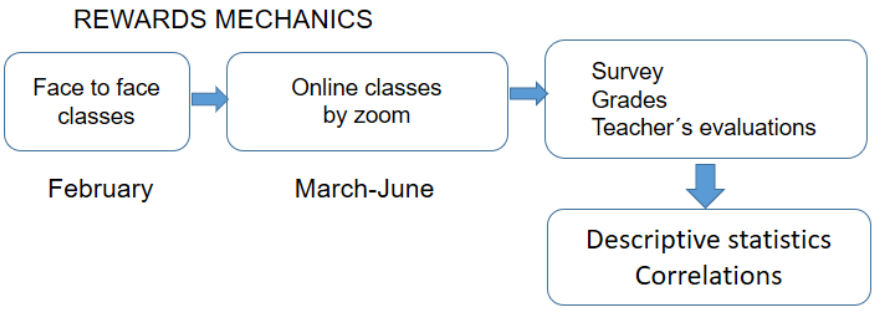

Figure 3. Research phases

In addition to the questionnaire, we considered the students' final grades. We counted the badges earned by each student to determine the correlation between the reward system and their academic performance. We also included teachers' evaluations, emphasising items related to gamification applied during the academic confinement. We processed all the data in Microsoft Excel for descriptive analysis, and we used SPSS software to calculate and analyse the correlations.

Particularly for the third research question, we complemented the analysis with the institutional evaluation of the professors, which all the university students use to evaluate their professors. This instrument also allows the students to assess the academic course challenge, have interactions with the professor, view procedures, and make other statements. This evaluation has 12 questions that students answer on a 0 to 100 scale at the end of the academic period. A centralised team processes the results. Teachers receive a report with the evaluation and comments from the students after registering the final grades. Results used in this research derive from the following questions:

a. About methodology and learning activities (providing clear and precise explanations, media, innovative techniques, and technological tools to facilitate and support my learning), the course was …
b. About the intellectual challenge (motivation to deliver my highest effort for the quality of my learning and personal growth), the course was …
c. Interactions with my professor during the academic confinement of the contingency have been …
d. Statement about the ethical issues.

The information collected for the research was authorised by the students and the institution under the agreement that it would be used for research purposes and will maintain students' anonymity.

Results

Research question 1: To what extent did gamification with a reward-based system motivate students in the academic confinement due to COVID-19?

We administered a questionnaire with a Likert-type scale to the students registered in both courses to answer this question. First, the students who took Calculus and then those enrolled in Development of Transversal Competencies are shown. Next, we discuss the results of some of the open-ended questions, followed by the teachers' evaluations.

Results for students in the calculus class

Forty students from the engineering degree program answered the questionnaire. Six women and 34 men ages 19 to 21 participated in the survey. The answers to the four questions are shown in Table 3.

Table 3
Class attendance, active participation, quality of homework, and positive emotions in calculus class

Question	Totally agree	Agree	Disagree	Totally disagree
Did the reward system motivate you to attend classes?	72%	25%	3%	0%
Did the reward system motivate you to take part in the class?	75%	20%	5%	0%
Do you think that the reward system motivates you to improve the quality of your homework?	67%	30%	3%	0%
When you earned a badge, did you feel a positive emotion?	92%	5%	3%	0%

The results indicated that 97% of the students who answered the questionnaire agreed that the rewards system helped them attend classes and improve their homework quality. In comparison, 95% said that the system motivated them to participate in class.

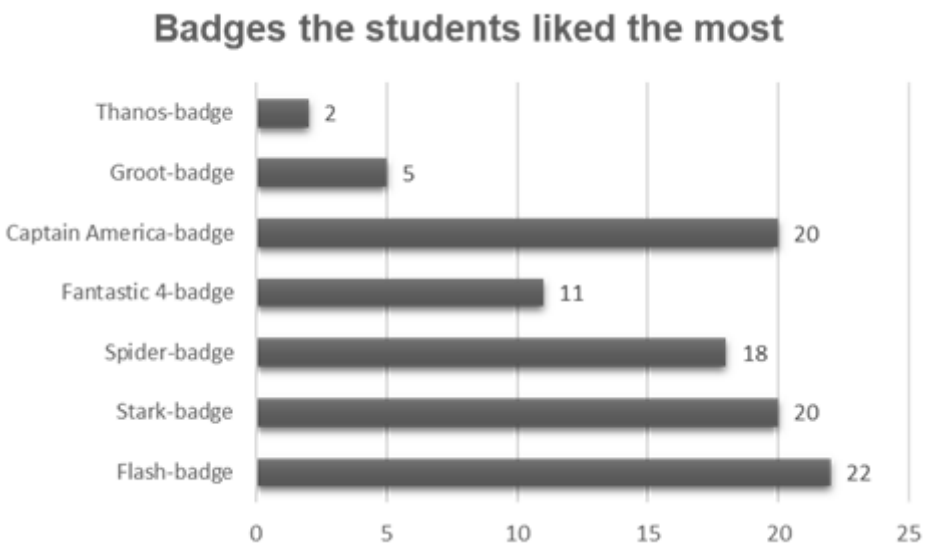

Figure 4. Badge occurrences

Figure 4 shows how striking it was that the badges that students frequently obtained were the Flash badge and the Stark badge, which rewarded class participation. In second place was the Captain America badge, which recognised quality in homework and activities. Some of the students' opinions were:

- I loved the badges because they help you and motivate you to stay in class. It is a way of showing that you are progressing.
- For me, they were a new system that I had not seen in any other class, and it made it more challenging and exciting.
- The more challenging the question, the more I tried to do my best on the tasks. I also really like teamwork.
- They reward students with qualities that I consider essential.

The answers to the students' open questions are consistent with Table 3, which highlights that they agreed that gamification based on a reward system motivated their class participation and improved the quality of their assignments.

Students enrolled in the Development of Transversal Competencies course

Likewise, we also administered questionnaire with a Likert-type scale to measure students' satisfaction with the rewards mechanics. Eleven students (four women and seven men) completed this questionnaire (Table 4).

Table 4
Results in the Development of Transversal Competencies course

Question	Totally agree	Agree	Disagree	Totally disagree
Do you think the reward system motivates you to participate and/or complete course assignments?	50%	50%	0%	0%
Do you think gamification relates to this course?	50%	40%	10%	0%

The survey results indicated that the reward system offered advantages for students beyond entertainment, on Table 4 we can see that fifty percent of the students found gamification, specially reward system, was related to the course content. This indicated that the students appreciated gamification as a course content reinforcement, not only a “funny” way to improve their performance or get extra points.

Resilience was the students' favourite badge because it recognised their personal effort, mainly in virtual classes during the pandemic situation. The Resilience badge was attached to different assignments, such as the mock interview, which requires a willingness to accept feedback and pay attention to details on an interview. It also was earned through classmates' voting in the virtual TecChallenge session. Students voted for their peers according to their performance during the online session. It was common to see the same students awarded Resilience and Audacity, the latter being the second-favourite badge in this course (Figure 5).

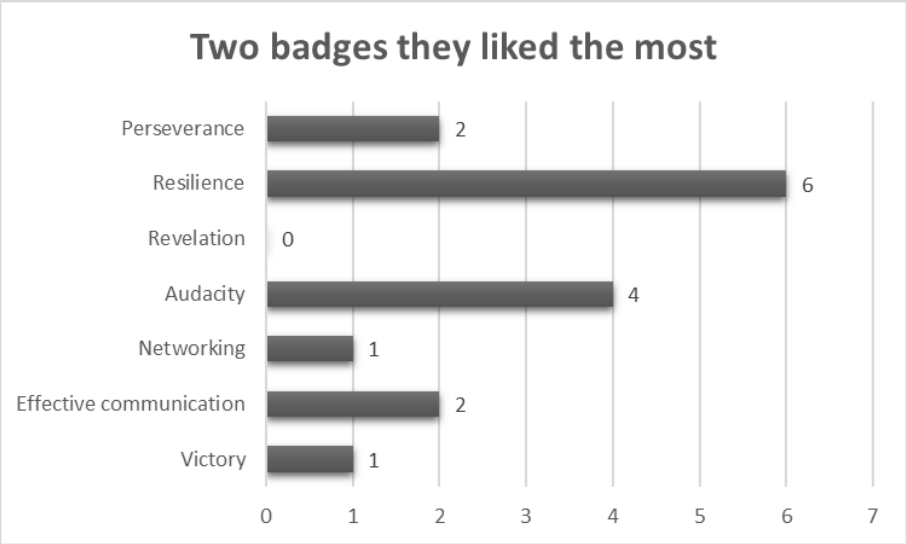

Figure 5. Students' favourite badges in the Development of Transversal Competencies course

One student specifically commented that the reward system inspired him to do a better job. Another student said that the best assignment was the one the Networking badge related to: using and improving their LinkedIn profile. This badge combined factors where students benefited from doing activities that help them get into the job market, something beyond traditional grade assignments. Thus, students did their assignments and took a step toward to getting an internship and becoming a professional.

When students were asked if they would add another badge, some mentioned competencies they would like to see reinforced through a badge. However, most of the students answered "none."

Research question 2: To what extent did gamification with a reward-based system improve students' attention and active participation during the academic confinement due to COVID-19?

Using information from the Calculus course, we observed that attention and active participation played particularly key roles, depending on the nature of the class. The badges linked to attention and active participation corresponded to the Flash and Stark badges. Since normality is not a necessary assumption (Nefzger & Drasgow, 1957) we estimated the correlation between the number of earned attention and active participation badges (Flash and Stark) per student and their grades in each evaluation period. The results are shown in Table 5.

Table 5
Pearson correlations between the attention badge and midterm (partial) exam scores

Grades	Period 1	*p* value	Period 2	*p* value	Period 3	*p* value
Pearson correlation (N = 44)	Flash-Stark_1	.240	Flash-Stark_2	.646	Flash-Stark_3	.555

* Correlation was significant at the 0.01 level (2-tailed)

Table 5 shows a good and positive correlation between attention badges and partial grades in the second and third evaluation periods (p-value < 0.05). Additionally, Table 6 shows the students' opinion of the Calculus class and the reward system.

Table 6
Opinions of the participants in the calculus class

Question	Totally agree	Agree	Disagree	Totally disagree
Did the reward system motivate you to pay attention in class?	67%	33%	0%	0%
Did the reward system motivate you to get involved with the class?	75%	20%	5%	0%

Based on this data, we found that 100% of the students agreed that the reward system encouraged them to pay attention to the Calculus Class. In comparison, 95% of them agreed that it motivated them to participate actively. Some students' opinions, when asked why they liked the Flash and Stark badges, provided more specific information about the effects of gamification with a reward system, were as follows:

- Because they make you keep abreast of what the teacher asks.
- Because they motivate you to do homework and attend class.
- Because they encourage participation and harmony with colleagues from other campuses.
- Because through quick questions, you confidently give answers.
- Because they challenge me to think quickly about the answer and be attentive in class (Flash); They helped me attend classes, participate, and help others (Captain America).
- They made me participate more in class.
- Because they commit you to do things well and to improve.
- Because they made me improve my homework and participation in class.

The students' opinions confirmed the statistical results and, at the same time, provided us with a deeper understanding of their feelings about the reward system.

Research question 3: To what extent did gamification with a reward-based system improve students' performance in the academic confinement due to COVID-19?

All badges that the students earned in the Calculus course were counted and correlated with their grades in the three testing periods (Table 7). This information showed a significant correlation in the three periods; even stronger in the second and third periods when a lockdown occurred. This indicated that gamification based on a reward system had a favourable effect on the students' academic performance in Calculus.

Table 7
Pearson correlations between badges and midterm (partial) grades of calculus course

Grades	Period 1	*p* value	Period 2	*p* value	Period 3	*p* value
Pearson correlation (N = 44)	Badges 1	.435*	Badges 2	.692*	Badges 3	.620*

* Correlation was significant at the 0.01 level (2-tailed)

For the Development of Transversal Competencies course, since the sample was less than 30, we performed a Spearman correlation test (Table 8). The results show a strong correlation between badges and the final grade, indicating that gamification based on a reward system helped student performance.

Table 8
Spearman's correlations of Development of Transversal Competencies course

		Correlations	Badges	Final grade
Spearman's rho	Badges	Correlation coefficient	1.000	.806*
		significant (2-tailed)		.000
		N		17
	Final grade	Correlation coefficient	.806*	1.000
		significant (2-tailed)	.000	
		N	17	

The results revealed a strong and positive correlation, showing that gamification using a reward system positively affected student performance. In general, we saw that in these two course scenarios, gamification with a reward system had a positive effect on the grades of students during the confinement of the Covid-19 pandemic. Also, the teachers' evaluations showed agreement with the pedagogical resources used in these two courses. This subject received ratings up to 9 on a 0 to 10 scale. The intellectual challenge was an important item in this evaluation, receiving 9.35 in Calculus and 9.0 in the Development of Transversal Competencies course (Table 9).

Table 9
Institutional teachers' evaluation

Course	Intellectual challenge	Pedagogical resources	Teacher's interaction in the academic confinement
Calculus	9.35	9.35	9.05
Development of Transversal Competencies	9.0	9.25	8.94

The results of the teacher evaluation report for the Calculus course suggest that both the pedagogical resources and the challenge worked in the new educational model. These results further confirmed the contribution of gamification during Covid-19 conditions. Furthermore, in both courses, students encountered a significant intellectual challenge and successfully undertook the pedagogical resources arried out in class (gamification). It is worth mentioning that the Calculus class required more changes and adaptation of content in the academic confinement context with respect to a face-to-face course, because of the subject's nature.

Discussion

During the lockdown caused by the Covid-19 pandemic, the students in the two undergraduate courses believed that the gamification strategy motivated them to attend class, participate, and carry out the activities, as verified in Tables 3, 4, and 6 These findings align with Park et al. (2019) and Morschheuser et al. (2019), who found that students perceived it as a pleasant experience to receive a benefit after completing a task or activity. In this sense, our study results proved that gamification applied with a reward system in higher education helped motivate and involve students in an online learning environment under stressful circumstances.

The research also established that the reward system could generate engagement with the course and improve flow. The Flash and Stark badges related to answering spontaneous questions from the teacher and requiring students to be attentive in class, were the favourites for engineering students (see Figure 4). The reward system also led to positive feelings about achievement (Deci & Ryan, 2008; Lefers & Birkenkrahe, 2016; Skinner & Belmont, 1993), generating behavioural, cognitive, and emotional commitment (Fredricks et al., 2004). Thus, we can affirm that the reward system favoured participation and flow in synchronous and asynchronous online activities.

Including badges in a class to recognise students' effort can sustain their attention and positively affect academic performance. The analysed results seen in Table 7 and are complemented by the students' opinions. These findings coincided with the studies (Davis & McPartland, 2012; Goodyear & Nathan-Roberts, 2017; Hamari et al., 2016; Hammedi et al., 2017) where it was found that badges increased

participation and students' intrinsic and extrinsic motivation by recognising their achievements and abilities. Hence, we can say that including badges in undergraduate classes improved academic performance.

Likewise, the results showed that a reward system improved the performance of students in different areas. Tables 7 and 8 show the strong correlation between the number of badges earned and the participants' performance in both courses. In the teachers' evaluation, the students' opinions were very similar (Table 9). Several authors agree that recognising students for their performance and achievements fosters a positive attitude toward learning and improves it (Rincon-Flores, López-Camacho et al., 2020; Rojas-López & Rincon-Flores, 2018; Santos-Guevara & Rincon-Flores, 2020; Smiderle et al., 2020). Consequently, we propose that a reward system that recognises cognitive aspects and skills, attitudes, and values can positively affect academic performance.

Several anthropological research investigations found that games were an intrinsic activity in the life of a human being of any age and gender (Santos-Guevara & Rincon-Flores, 2021; Smiderle et al., 2020; Stefani et al., 2014). Therefore, gamification as part of educational strategy can transform learning environments into more enjoyable processes, as a result of the recognition of the student, both in the cognitive aspects, attitudes, and values, as well as the atmosphere of constructive competition generated by the reward system. We also highlight an interesting finding that confirmed how gamification is seen as interactive. In the Calculus class, badges were given almost instantaneously when students earned them. In contrast, in the other course, badges were given after one or two sessions, when students' assignments were graded, or the group voting was completed. We observed a slight but significant difference in the teacher's evaluation for interactivity. Even though different factors, unrelated to gamification, affected this evaluation, we recommend researching this correlation in the future.

Finally, the research results showed that gamification with a reward system boosted the participants' attention, active learning, and performance, making the learning environment more pleasant and exciting. Thus, these results are optimistic and promising in a confined environment that generated stress, isolation, and depression among some students (Arnove, 2020; Daniel, 2020; APA, 2020). Continuous participant recognition helped their emotional states (Korving et al., 2016 Thomas & Rogers, 2020; Zhao, 2020), particularly in learning environments developed during a global health crisis.

Conclusions

The COVID-19 pandemic forced us to migrate traditional courses with little interaction to the virtual teaching. Here, gamification played a crucial role in motivating students and increasing their participation. This model embraced gamification in education. Student require significant learning, which can be obtained through gamification mechanics. After analysing students' efforts, participation, and improvement in academic performance, we consider this experience was successful. The results in both courses indicated that gamification improved the learning process in different settings and contexts.

Motivation is crucial in education; however, its necessity is even more urgent in a lockdown situation because it causes students to vary in their emotional and mental states. Gamification can create a dynamic learning and safe environment that motivates, boosts autonomy and flexibility, and provides frequent positive stimuli. It can also reduce frustration caused by sudden changes, because Covid-10 pandemic, and a need to improve students' emotional state, thus, transforming education beyond the mere awarding of academic credits.

Interactions are affected if the students see the leaderboard infrequently used, so we recommend that teachers take the time to update the leaderboard as frequently as possible to show student progress. Also, we suggest establishing a maximum number of badges in each class, depending on the nature of the course, to motivate all students to participate. The education designer must consider the reward system mechanics carefully in the course design.

The main objective of the gamification proposal in this study, which focused on students' attention, active participation, and performance in the two undergraduate-level courses, was achieved despite the sudden migration from a face-to-face teaching model to a virtual one. Gamification is of particular interest in these pandemic times because people need more digital social interactions to counteract the loss of social contact

in the university classroom. Furthermore, this research shows that gamification is a teaching strategy that can potentially be applied in any discipline and learning environment.

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Gamit! a beat for learning

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***Abstract*— This paper presents the results from a gamification platform developed by two Latin American universities from Mexico and Peru, with the aim to promote engagement and improve students´ attitudes towards the learning process, as well as facilitate the professors' work. The methodological approach to this research was qualitative on the course Modeling of Movement in Engineering where students used the platform named Gamit! for five weeks. The study dimensions are attention, engagement, resilience, and usability to continue the previous research.**

Keywords*— *gamification, leaderboards, web platform, rewards mechanics, educational innovation, higher education

I. Introduction

Gamification improved throughout the use of a web platform that allows the management of leaderboards, helps teachers reduce manual tasks and allows them to focus on students and learning.

Evolution of educational systems and the development of cognitive science have sought to understand cognitive processes and how we can remain motivated for learning. We are interested in learning more than actual grades and gamification seems to contribute to this goal.

Gamification has proven to be advantageous because it enables a pleasant scenario for learning where students can forget for a while they are listening to a boring class, perhaps learning useless theories or solving not real-life problems, in essence what is known as *traditional and ineffective learning* [1].

Controversy on gamification effectiveness is still a study subject. A group of professionals consider learning a serious task, and, therefore, with no room for playing or following strategies that facilitate learning and the experience itself. Nevertheless, research points out that the most gamification studied area comes from educational [2] agreeing on its benefits towards learning.

A. Gamit!

Gamit! was born as a collaborative contribution from two Latin American universities which aims to contribute to innovate educational processes and tools that facilitate learning for higher education. Then, joined efforts from gamification methodology and technological awareness, helped towards enlighten of Gamit! to help both teachers and students to manage a gamified course through an easy-to-use web platform. Teachers, as gamification designers and course owners, are allowed to create a class and as many leaderboards as their class design requires for each subject. They decide their narrative using community badges or creating their own. Students visualize leaderboards and get notifications when a badge is assigned to them as well as they choose and avatar that represents them by keeping their identity anonymous. Class ranking by avatars is shown based on the students ´earned points awarded previously by the teacher. Figure 1 shows the key features of Gamit!.

One of the main challenges that we faced was that, Gamit! would be used by the two universities in different countries, geographically far from each other. That is why the software architecture proposed by the team was to use cloud services, to have more flexibility of computing resources, availability and connection.

Design features are essential attributes for easy-to-use platforms, and gamification. As part of the platform customization, the institutional image of the two universities was fused. The aim was to find a design balance that represents both universities in their own image identities, for which several graphic design tests were carried out resulting in the use of a gradient that combines the blue of the universities. This resource is used as a visual background for the platform and allows Gamit! to have its own personality.

Furthermore, Gamit! presents two leaderboard versions, one for the students and another for the teachers including names and

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avatars. Thinking of the different options that teachers may have for their badges, class size, and students' avatars, the two versions present all the information in an integrative and simple way.

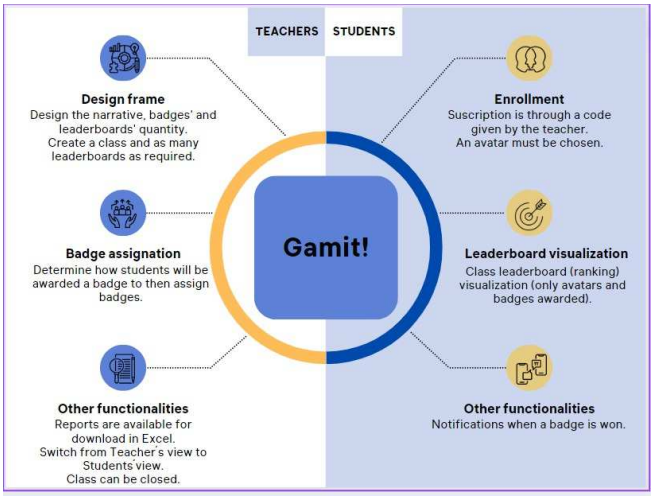


Fig. 1. Gamit! features.

II. Theoretical Framework

A. Gamification on Higher Education

There are theories that teach us how motivation works on different processes such as learning [3, 4, 5]. Also, we learned from games like *Farmville* [2] that challenges must be attainable, otherwise people will quit the game [6]. Efforts need to be rewarded but the rewards must be given in a constant way to keep players engaged [7] but also on a pace that reflect progress [8], otherwise gamification may be seen as a distractor or an additament, instead of a contributor or reinforcement for special features, attitudes, behaviors, and tasks.

Researchers have shown that software designs must be user-friendly and allow engagement in students into a gamified narrative in order to keep their attention, as well as in the course content. Enjoyable experiences contribute to increased learning scenarios where motivated students can approach opportunities to succeed [9].

Gamification, like other pedagogical techniques, has characteristics and rules that must be followed to succeed. We recognize that there are gamification experiences that have not been satisfactory; however, it is possible to review those implications to continue improving this methodology. First, a way to understand gamification is the proposal from Dixon in which there is an intentional design to a gamed design, therefore a solid structure is needed [5]. The most generalized definition to gamification is the use of game elements on non-game scenarios, such as learning [10, 11].

Based on the Werbach and Hunter model [12] there are three main points to consider in gamification design: dynamics, mechanics, and components. The dynamics are the contexts in which the gamification is developed (for example, emotional narrative, social, progressions). The mechanics are the activities inside the dynamics (for example, challenges, opportunities, rewards). And the components (i.e., badges, points, boards of classification) are the objects, digital or not, used in the mechanics.

Leaderboards are one of the most widely used components. When they are used, they represent the main axis for the experience because they show progress and position [13]. Badges are representations, icons, of achievements of learning [14], they may be for actual demonstration of acquired knowledge or a specific behavior or attitude towards learning. Another essential element to this model is the use of avatars to represent students as class members [15] to keep their identities anonymous. Gamification can also improve learning and curiosity beyond competition.

B. Gamification, teachers and learning environments.

People prefer to work on activities that foster their results and efficiency, when they are pleasantly involved. Students and teachers are not an exception [16], however gamification management may represent a demanding and overwhelming task for teachers, so they may also end up quitting the gamification experience. As well as an overwhelming reward system may cause students to desert [17].

Updating leaderboards in real-time is essential to keep the attention and expectation of students, otherwise, the gamification pace will decrease or be interrupted [18]. However, previous studies [19] have shown that leaderboards are not updated in real-time or the students can not visualize them on their own, they depend on the teacher to do so. Complementary, seen as an opportunity, to show the leaderboard in class contributes to catch attention and reinforce healthier interactions in different ways (student – student, student – teacher). According to research, students prioritize their involvement on a course with friendly learning environments and flexibility. Guzzardo et. al [20] reported students felt more engaged when they found accessible teachers who accompanied them, influencing positively their academic approach. Socialization through leaderboards boost interactions and collaboration between teachers and students, thus, increasing their performance and motivation.

Other studies show that the technology use on gamification improves a sense of instant gratification for students and student's engagement appreciation for teachers [21]. Moreover, students feel attracted to visual and organized information instead of plain presentations such as an Excel sheet. Although there are apps and websites that offer gamification options, personalization options are limited, or the costs are onerous. Araujo [22] reported difficulties for teachers to implement gamification in their courses on three main areas: previous teacher experience with games, time to manage and design gamification, and technology use. This last point referred not only to management, also students advisory and its consequent time consumption.

C. Gamification and platforms

There are LMS, such as Moodle, that integrates gamification elements to their overall features [23]. Challenges occur when

permission is unavailable or there is a lack of training in platform use, and other technical limitations, like payments. Therefore, an open-access resource to gamification management needs to be aligned with the Werbach and Hunter model and its demands.

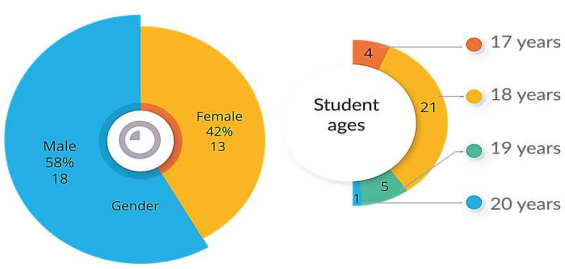
Gamification needs a touch of customization for better results. One requirement is the ability to grab attention and offer attractive elements to keep learners engaged [24]. When teachers adopt a narrative approach without a sense of belonging, not related to the course, or with no meaning for students, gamification is doomed to fail because gamification is intended to be user-centered instead of mechanic-centered [25].

Studies show teachers preferred to use Edmodo, Educaplay, Kahoot, among other sites, in which they do not need to design, spend extra time to implement it or guide students on the platform use [26]. However, lthe language of the tool and the costs associated to its use represent issues for some teachers and students.

III. Method

Our gamification methodology is based on Werbach and Hunter model [11]. We propose a narrative based on superheroes. Students choose an avatar to participate on the leaderboard and give badges according to the badge description in this context. The methodological approach was quantitative, with the aim of answering the question: What is the relationship of a gamification methodology based on a reward mechanic with respect to the dimensions of attention, engagement, resilience, and usability?

For this purpose, a previously validated questionnaire for experts and Cronbach Alpha equal to 0.928 was applied and divided into the dimensions: attention, engagement, resilience, and usability. Figure 2a and 2b show the distribution by gender and age.



(a) (b)

Fig. 2. Gender and age distribution.

The sample was of thirty-one students from the School of Engineering and Sciences, from the course Modeling of Movement in Engineering. The students use Gamit! platform during five weeks. It is important to note that this study is the continuation of [18]; unlike the previous study where usability was evaluated, this study besides evaluates the dimensions of attention, engagement, and resilience.

IV. Results

The results of the study are presented below. Figure 2 shows the overall results by dimension on a 0 to 10 scale.

Fig. 3. Overall results by dimension.

The results show the dimension Engagement had the highest rating (8.5/10), followed by Usability and Resilience (8.4/10). In this sense, the Gamification methodology based on a reward mechanic favors Engagement and Resilience in students and the user experience of the Gamit! platform is positive. In Figure 3 we can see the results by statement.

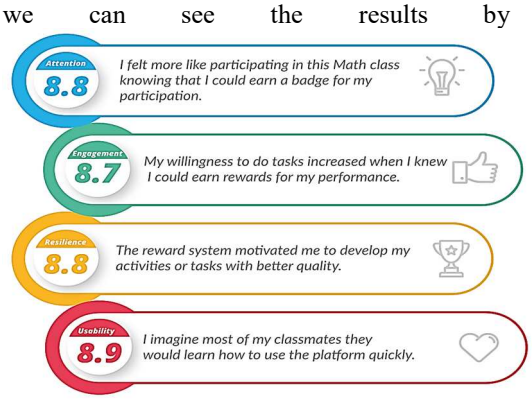


Fig. 4. Results by statement.

The results show students perceive positively both the gamification methodology based on a reward mechanic and the Gamit! platform.

Certainly, qualitative results also were found, some of which are represented in the comments on Figure 4. Also, the teachers' perception is balanced to set the gamification goal to increase the class results are positive to this experience. Teachers identified enhanced attitudes between students and with class content.

V. Discussion

Results showed acceptable parameters to consider gamification as a pleasant experience for students. As seen in Figure 4, some students commented that they would like other courses to be gamified as the current course, also, they were satisfied with participation benefits. These results coincide with the results of several studies [3, 4, 5, 10]. In this sense, gamification based on a reward mechanic can contribute to improving the learning experience, through engagement and other attributes. As well as we consider gamification may represent an introductory way

to a comfortable class environment in which learning is not only an option but a pleasant activity.

We centered on these four dimensions (attention, engagement, resilience, and usability) that represent common learning challenges because sustained attention, attention at key moments in the process of teaching mathematics, is important to maintain the flow of learning. Engagement is important to keep the students interested and motivated; this is also important since the gamification methodology presented in this study recognizes cognitive aspects, skills, attitudes, and values giving students different alternatives to stand out and be recognized. These aspects have also been addressed in the studies of [26, 27] and are perceived as defiant to teachers and academics.

On the other hand, the fourth dimensions, usability, results showed that the web platform, effectively, is easy-to-use and represents no distraction in the teaching learning process. This is important as Gamit! was developed with the purpose of facilitating the management of the gamification methodology to teachers and of course, to set up learning experiences more attractive for students, this undoubtedly favors engagement and enjoyment for both, teachers, and students.

Studies show gamification fosters different subjects, such as science [27], or, in this case Modeling of Movement in Engineering. We are not trying to emphasize the course itself, even though we agree on the belief that people are willing to use gamification when they do not find difficulties understanding the game nor in the use of the platform. When gamification makes sense to everyone despite of personal preferences for specific characters (meaning that the narrative is understandable for everyone), interactions are improved, and class is energized. Besides this, gamers demand a goal [28] and benefits for playing. On the course we presented, students found on Gamit! an ally to gamification without sacrificing the learning experience, or their time.

While it is true that learning is related to the four dimensions presented in Figure 3, and observation confirms a boosted class environment, we are not assuming that students learned the course content; this makes us consider that there is still room to validate learning. Grades do not necessarily represent a learning improvement, this discussion is outside the purpose of this study, what we mean is that teachers found a more involved-on-learning methodology. There is still a need to better understand the straightforward translation of gamified experiences and learning beyond the entertainment, playful environment, and involvement.

VI. Conclusion

Academics are constantly looking for alternatives to boost and facilitate learning. The most widely used version of gamification in education is the Werbach and Hunter model which proposes the use of elements such as narrative, badges, leaderboards, and avatars. Research has shown gamification has positive results on engagement and attitude to learning, specifically, in this case, to Math courses in which students are invited to participate and get benefits from it.

Gamit! is a tool that helps teachers and students to keep track of gamification results, in this case the class ranking is visualized on an easy-to-use platform in which class content (leaderboard) is only shown to class members. Gamit! helps teachers to manage the gamification mechanics using time and efforts more efficiently.

Students are open to gamified courses and teachers are satisfied to use a platform which helps them to manage this process. Gamit! allows teachers to be the narrative designers and connect with their students in their courses.

Finally, another aspect that we want to specify is the richness of collaborative work when the knowledge and skills of two Latin American universities come together to create an educational resource for the benefit of their students and teachers, which can be extended to various educational institutions in other countries.

Gamification is devoted to enhancing learning no matter the course or subject. Gamification design principles must be attended to guaranty a familiar context for everyone, exploding enjoyable learning experiences.

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Gamit!: plataforma para la gamificación basada en un sistema de recompensas para estudiantes universitarios

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RESUMEN. La gamificación es una técnica que permite utilizar en distintos contextos las que se presentan en los juegos. En la actualidad, existen varias iniciativas para aplicarla en contextos educativos, las cuales buscan impactar en la experiencia de los estudiantes mediante la mejora en la motivación (Surendeleg et al., 2014; Hamari et al., 2015; Rincón-Flores et al., 2018) y la atención de ellos (Hamari & Keronen, 2017). Para una correcta aplicación de la gamificación,

es necesario basarse en alguna metodología que ordene y facilite su adopción, así como una herramienta que dinamice su utilización por parte de los docentes y los estudiantes. Gamit! es una plataforma tecnológica de gamificación cuyo valor radica en facilitar la adopción de esta técnica mediante una metodología basada en narrativas.

PALABRAS CLAVE: gamificación, educación superior, innovación educativa

GAMIT!: A GAMIFICATION PLATFORM FOR UNIVERSITY STUDENTS BASED ON A REWARD SYSTEM

ABSTRACT. Gamification is a technique that uses game concepts in domains different from games. There are many gamification initiatives in education because of its impact on student experience, especially in motivation (Surendeleg et al., 2014; Hamari et al., 2015; Rincón-Flores et al., 2018) and focus (Hamari & Keronen, 2017). A methodology for easy game-concept adoption and tools to help teachers and students in gamification activities are necessary for proper gamification. Gamit! uses a narrative-based methodology to make gamification easier to follow and implement in classes.

KEYWORDS: gamification, higher education, educational innovation

1. INTRODUCIÓN

Algunos de los retos que se presentaron en la implementación de la gamificación, antes del uso de la plataforma Gamit!, se centran en la administración de la dinámica, desde la narrativa hasta la socialización de las insignias que se otorgaron. La gestión del tiempo y la información fue uno de los retos mayores y que mermó el resultado inicial de la gamificación al convertirse en una carga adicional para el docente. Por otro lado, el tablero de liderazgo se visualizaba como plano, sin diseño y con un acomodo poco atractivo para los alumnos. A su vez, la socialización del tablero tuvo diferentes áreas de oportunidad en la elección de la mejor manera de presentarlo en cada plataforma o en cada ocasión que el docente compartía la información, o que los alumnos consultaron las insignias obtenidas.

2. PRESENTACIÓN

La discusión realizada por el panel se centró en la utilización de la gamificación como herramienta para mejorar la motivación por parte de los estudiantes en instituciones de educación superior. Los resultados mostrados se basaron en los de la implementación y utilización de la plataforma web llamada Gamit! (Rincón-Flores et al., 2022) en cursos de educación superior en la Universidad de Lima (Perú), así como en el Tecnológico de Monterrey (México).

Sobre la base de la experiencia realizada por los expositores, se analizaron los puntos a favor y los problemas de la aplicación de gamificación. Además, se planteó una guía para la implementación de una metodología de gamificación basada en narrativas.

3. CONCLUSIONES

La gamificación ofrece beneficios pedagógicos que modifican el ambiente de aprendizaje en cuanto a la relación que se establece en diferentes direcciones: alumno-contenido, alumno-profesor, alumno-alumno. Sin embargo, para la obtención de dichos beneficios, se requiere un diseño apropiado y contextualizado para cada asignatura.

El uso de la tecnología, como lo es la plataforma Gamit!, facilita la implementación de la gamificación en un ambiente digital seguro y más atractivo, que, además, contribuye a la administración de la técnica para que el usuario (docente y alumnos) se centren en el aprendizaje y en el aprovechamiento de los recursos educativos.

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Gamit! Icing on the Cake for Mathematics Gamification

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Abstract: Gamification has permeated education as a strategy to improve the teaching-learning process. Research shows that gamified reward systems based on badges, leaderboards, and avatars modifies the learning environment and student attitudes. This research aimed primarily to assess the change in attitude towards mathematics in high school students through a gamified methodology involving a reward system managed through a web platform called Gamit! This platform was developed by professors from two Latin American universities to manage gamification in a way that ensured that the anonymity of the class rankings was maintained. A mixed (QUAN-Qual) and quasi-experimental methodological approach was used for this study; two questionnaires were applied to 454 high school students and a focus group was performed with a group of seven professors. The quantitative analysis was processed with SPSS and consisted of ANOVAS and post hoc tests for more than two samples, while the focus group analysis was performed through inductive analysis. Results show benefits for professors and learners. Students improved their attitudes toward mathematics, reducing anxiety and improving willingness, while professors found a dynamic and optimal way to manage gamification on Gamit!

Keywords: gamification; innovative education; digital leaderboards; attitude toward mathematics; math education

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1. Introduction

Over the years, there has been a need to promote lifelong learning as it recognizes the importance of establishing teaching experiences that have a positive effect on people's lives. If it is possible to foster a taste for learning in addition to achieving the development of useful and lasting skills and knowledge, we will have achieved educational success.

One of the concerns in the teaching of mathematics is the low rate of academic success [1]. Although some of the causes are attributed to the process of teaching, this lack of success is also due to the lack of didactic strategies that promote active learning [2,3]. In this sense and because of recurrent practices and research, gamification based on a reward mechanism is one of the educational tools that favors active learning [4–7], and in the literature we can find a vast number of studies that support this statement [8–11]. In 2017, a methodology based on the mechanics of rewards was applied in a Mexican university, which consisted of rewarding the knowledge, attitudes, values, and skills of the students through diverse types of badges. These were initially placed on a physical board, and the students were represented by an avatar whose image was received by the professor via email. The professor was then given the task of updating and pasting the badges awarded to the students to the physical board on a weekly basis; although the results of gamification were rewarding, the physical handling of the board represented extra work for the professor.

Collaboration between universities is essential to generate innovative methods in academic environments [12]. In that sense, the Tec de Monterrey of Mexico and the Universidad de Lima from Peru have worked to develop synergies since 2019 to implement Gamit! Gamit! is an interactive gamification digital platform designed for higher education professors and students. It is based on a reward system that recognizes student performance and skills using badges, avatars, and leaderboards. The team of Mexican researchers proposed the methodology for Gamit!, while the Peruvian researchers proposed the implementation of Gamit! on a digital web platform that would facilitate the management of gamification for professors and students.

The usage of technological tools usage in education has been rising, especially during the pandemic. These tools usually help professors and students be more connected and have common resources to find information. That is why we planned to build a web platform that helps instructors adopt gamification techniques and lets them use it during their classes more easily without creating extra work. The key features that the platform implements are divided into two parts: the ones that are tailored to instructors and the ones that focus on students' needs. In the case of instructors, they can manage their leaderboards, assign badges to students, and visualize a performance report. Students can register in a class, select an avatar, and see their performance within a class on the leaderboard.

At the communication level, it was important to find a balance between the institutional image of the two universities. For this, several graphic design tests were carried out, and the use of a gradient color that combines both institutional colors was selected: the blue of the Tec de Monterrey and the orange of the Universidad de Lima. This resource was used as a visual background for the platform and allows Gamit! to give its own character.

Before presenting the methodology and results, a review of the literature is shown in which the topics of attitudes toward mathematics and educational gamification are addressed with the purpose of offering a conceptual frame.

1.1. Why Are Attitudes toward Mathematics Important in Learning?

Mathematics is a subject that is still present in the current era, and surely every professor of this subject fervently believes that the basic learning of mathematics should be a natural process since it is inherent to any area that a high school student should know regardless of the career, he/she is about to choose. However, high school students' attitudes toward math remains a challenge for many professors, at least in Latin America. In Mexico, 66% of students who complete a high school education have insufficient curricular mathematical knowledge [13], and on average, Latin American students were at the lowest level in the PISA test (Programme for International Student Assessment) according to results published in 2019 [14].

The attitude towards mathematics is defined as the affective response, whether positive or negative, which implies a personal commitment and generates a behavior. In other words, it is how the student responds to learning mathematics [15,16]. Attitudes are composed of three elements: cognitive, affective, and behavioral. *Cognitive* consists of ideas, perceptions, beliefs, and opinions; *affective* consists primarily of feelings, such as those of liking or disliking; and *behavioral* consists of a visible reaction, tendencies, dispositions, or intentions [17–19].

According to Auzmendi [20], attitudes towards mathematics can be characterized in five dimensions: *anxiety*, the feeling of fear that the student manifests before the subject; *enjoyment*, the joy that the mathematical work provokes in the subject; *utility*, the usefulness that the student perceives that the subject may have in his future professional life; *motivation*, towards its study and use; and *confidence*, the feeling of security in math ability. The study [21] found that the meanings that students share about attitudes towards mathematics are participatory, democratic, and inclusive processes that allow them to express anxiety, confidence, utility, motivation, and an interest in mathematics.

Math anxiety is an important problem and is insufficiently addressed in the teaching of mathematics, at least in Latin American countries, because students who suffer from it

to a lesser or greater degree receive surge of intrusive thoughts when they try to solve a mathematical problem; there is even a negative correlation between mathematical anxiety and math performance [22]. Similarly, in another study, they confirmed the hypothesis proposed by others that attitudes towards mathematics are related to performance, particularly anxiety and enjoyment being significant predictors of math performance [23].

The topic of attitudes towards mathematics becomes more valuable in adolescents, since during high school they take many mathematics courses, and, in addition, their physiological stage is complex [24]. For these reasons, in the present study, it was decided to measure the impact of gamification based on the mechanics of rewards in attitudes toward mathematics with the purpose of offering the scientific and academic community the possibility of improving the math teaching-learning process.

1.2. Gamification to Ice the Cake for Learning

Gamification emerged as one of these pedagogical strategies giving rise to the use of game elements in educational scenarios that in principle are not for play. Research on teaching techniques and learning motivation shows that a pleasant, comfortable, safe, and enjoyable environment [11] is a good start to promote lifelong learning and achieve encouraging results for educational systems. Even though students may perceive learning as boring [25], gamification is able to enhance the learning process. The authors view gamification as offering experience creation and recreation, that can produce behavior changes with a sense of autonomy and dominance [26].

García et al. [27] points out that learning has typically been focused on passing exams more than long-life learning, incentivizing extrinsic motivation instead of intrinsic motivation. Gamification looks for active learning, increasing intrinsic motivation [28].

The starting point is to ask ourselves what the objective of gamifying is, either in whole or in part, and why gamification could help us to achieve the desired objective. Once this becomes clear, we will have to make a detailed and intentional design that frames the gamification that must necessarily be related to the course.

The danger of choosing a disconnected or unfamiliar frame for gamification can last not only as an overexertion without appropriate results but can even cause results opposite to those desired [29,30]. It is possible that gamification generates additional stress or work as a distractor rather than being a benefit when there is no relationship or support for the subject used.

Thus, if we have already decided that gamification is the technique that can support us with our learning objectives, it is necessary to think carefully about what our narrative will be. A narrative is one of the most principal elements concerning these models [31], because it sets the context and determines the connection between the gaming experience and users' interest and engagement. The narrative can be seen as the theme in which each gamification is based.

Badges and leaderboards are the most frequently used gamified elements, serving as enablers for competition, motivation, and feedback providers [32]. Badges are a representation of achievement and are earned by completing tasks. They also represent interests or affiliation [33]. Leaderboards work on different tracks; they show scores, rankings, avatars, progress, and, more than anything else, they contribute to engage members through the achievement's socialization, in this case, for learning purposes and collaboration [30].

Interactions are another principal element for learning and are increased by gamification [29]; they give a sense of belonging and partnership needed to maintain behaviors and motivation [32].

On the other hand, design is a key element in gamification, and not only should the narrative be interesting and meaningful for students, the experience and look are what makes gamification attractive [34] and lasting.

2. Materials and Methods

2.1. Methodology

The methodological approach was mixed and quasi-experimental, of the QUAN-Qual type (with a dominant quantitative element), with the aim of complementing the quantitative results with the qualitative ones [35]. The sample consisted of 454 students, which was representative (N = 2400, $\propto = 0.05$, n = 332). Regarding professors, seven participated, and four of them have been using the gamification methodology since August 2021. The present study was carried out during the August-December 2022 semester. The research objective was to assess the change in attitude towards mathematics in high school students through a gamified methodology involving a reward system managed through a web platform called Gamit!

The study was conducted through the following research questions:

1. How did the reward-based gamification methodology influence high school students' attitudes toward math?
2. What is the relationship between the gamification methodology based on a reward mechanic and the attention, engagement, and resilience dimensions on the part of students and professors?
3. What is the perception of the usability of the Gamit! platform by students and professors?

The purpose of the first question was to answer the main objective of the research, and the second provided information on the aspects of attention, motivation, resilience, and engagement from the perspective of both actors, students, and teachers; these are key elements in the teaching-learning process and at the same time are related to gamification. Finally, the third yielded information about the user experience, which will improve the platform.

To answer these questions, a questionnaire was given to students before and at the end of the courses on attitudes towards mathematics [20], as well as a questionnaire on the dimension's usability, engagement, and resilience, whose Cronbach's alphas were 0.822, 0.903, 0.915 and 0.929, respectively. Both instruments correspond to a Likert-type scale but are continuous from 1 to 10 points. The analyses performed were processed with SPSS and consisted of ANOVAS and post hoc tests for more than two samples.

In addition, a focus group was created for the professors in which the same dimensions as with the students were addressed, and we applied an inductive analysis. The focus group description was the first presented topic by the moderator, as well as mention of the dimensions and students' questionnaires. The conversation began by getting to professors' experiences with gamification and the way in which each one implemented it. Once all had the main idea and the referenced experience as a starting point, the dimensions were approached in the same order that they appeared on the students' questionaries. The analysis was performed by another person and validated by the moderator and the observer.

2.2. Results

First, we will present the sociodemographic results. Of the 454 students who participated in the study, 49.8% were male, 48.9% were female, and 1.3% of students preferred not to say. Fifty-five percent (55%) of young people had a scholarship, while 83.5% attended the bicultural program (students who take courses in Spanish and English) and the rest attended the multicultural one (students who study subjects in more than two languages). On the other hand, 55% of the students attended the first semester, 29% attended the third semester, and 15.91% attended the fifth semester. The ages of pupils ranged from 14 to 18. Figure 1 shows the distribution.

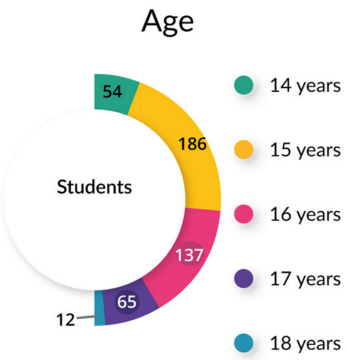

Figure 1. Students' age.

As we can see, most of the students were between the ages of 15 and 16 years.

2.2.1. First Question Results

We will now address the first question: How did the gamification methodology, based on a reward mechanism, influence high school students' attitudes toward mathematics?

The Auzmendi Attitudes Towards Mathematics test [20] was applied, which is formed by the dimensions of anxiety, pleasure, utility, motivation, and confidence. Additionally, the procrastination dimension of another instrument [36] was adapted and added. Table 1 shows the overall results.

Table 1. Overall Attitude toward mathematics results.

Dimension	Pre-Test	Post-Test	Significance ∝
Anxiety	6.01 (2.2)	**6.37 (2.2)**	∝= **0.014**
Enjoyment	4.69 (2.22)	**5.16 (2.4)**	∝= **0.002**
Usefulness	6.35 (1.9)	**6.4 (2.03)**	∝= 0.756
Motivation	**7.13 (1.87)**	6.8 (2.2)	∝= **0.009**
Confidence	**8.4 (1.57)**	6.9 (1.43)	∝= 0.826
Procrastination	**6.89 (1.43)**	6.7 (1.54)	∝= **0.043**

The results of Table 1 show favorable results in the dimensions of anxiety and enjoyment, which is to say that at the end of the course the students demonstrated and improved their ability to improve anxiety and indicated an increased liking of mathematics; however, in the dimensions of motivation and procrastination, the results were not favorable, because at the beginning of the semester the students perceived themselves to more motivated by mathematics than at the end; similarly, their resources to avoid procrastination decreased. Table 2 shows the correlations.

Table 2. Dimension correlations.

	Anxiety	Enjoyment	Usefulness	Motivation	Confidence	Procrastination
Anxiety	1	0.559 **	0.529 **	0.401 **	0.381 **	0.543 **
Enjoyment		1	0.661 **	0.224 **	0.505 **	0.434 **
Usefulness			1	0.408 **	0.526 **	0.397 **
Motivation				1	0.328 **	0.369 **
Confidence					1	0.332 **
Procrastination						1

** $\alpha = 0.01$.

It can be observed that the correlation between the dimensions is positive but not strong; the highest correlation is between usefulness and enjoyment; however, in the usefulness dimension, no significant difference was found. However, when the results were analyzed by category, including professor, scholarship, gender, program (bicultural or

multicultural) and semester, the following findings were obtained. Professor 1 obtained a significant favorable difference in the anxiety dimension ($\propto = 0.21$) and ($\propto = 0.029$) enjoyment; and professor 8 was close in the anxiety dimension ($\propto = 0.051$). The rest of the professors showed no significant difference. With respect to scholarship status, non-scholarship students showed an unfavorable result in the motivation and ($\propto = 0.001$) procrastination dimensions ($\propto = 0.016$), while scholarship students showed favorable results in the anxiety ($\propto = 0.041$) and enjoyment dimension ($\propto = 0.002$).

With respect to gender, both women and men showed significant differences in the satisfaction dimension, although ($\propto = 0.020$) men had an unfavorable result in the motivation dimension ($\propto = 0.025$). In the semester category, it was found that younger students showed an improvement in the anxiety ($\propto = 0.01$) and enjoyment dimensions ($\propto = 0.033$), while the result in the motivation dimension decreased ($\propto = 0.020$) ($\propto = 0.013$). In the rest of the semesters, no significant differences were found in any dimension.

Finally, with respect to the program, the students of the multicultural program did not show significant changes between the pre-test and post-test, while the students of the bicultural program showed significant favorable differences in the anxiety dimension and ($\propto = 0.019$) enjoyment ($\propto = 0.001$), as well as significant unfavorable differences in the motivation ($\propto = 0.011$) and procrastination ($\propto = 0.033$) dimensions. The means are shown in Table 3.

Table 3. Means and deviation standards of significative results.

Category	Pre-Test Mean	Post-Test Mean
Professor 1 (anxiety)	5.92 (2.07)	6.67 (2.08)
Professor 1 (enjoyment)	4.95 (2.14)	5.74 (2.51)
Professor 8 (anxiety)	6.03 (1.92)	6.69 (2.05)
No scholarship (motivation)	6.93 (1.84)	6.28 (2.04)
No scholarship (procrastination)	6.76 (1.33)	6.42 (1.5)
Scholarship (anxiety)	6.36 (2.12)	6.77 (2.19)
Scholarship (enjoyment)	4.93 (2.23)	5.59 (2.38)
Scholarship (motivation)	7.02 (1.96)	6.5 (1.88)
Semester 1(anxiety)	5.97 (2.17)	6.39 (2.27)
Semester 1(enjoyment)	4.95 (2.28)	5.44 (2.44)
Semester 1(motivation)	7.27 (1.87)	6.82 (2.18)
Bicultural program (anxiety)	5.98 (2.15)	6.36 (2.24)
Bicultural program (enjoyment)	4.6 (2.21)	5.15 (2.44)
Bicultural program (motivation)	7.10 (1.91)	6.72 (2.2)
Bicultural program (procrastination)	6.9 (1.42)	6.67 (1.52)

It is interesting to see that in the categories of male and female students, scholarship holders, first income, and the bicultural program obtained better results in the anxiety and pleasure dimensions, and decreased in the motivation dimension in the categories man, non-scholarship, first income, and bicultural program.

Additionally, the hours of study that the students dedicated at the beginning and end of the course were obtained, and the results are shown in Figure 2.

It can be seen that at the end of the course the students dedicated more hours of study than they did at the beginning of the course.

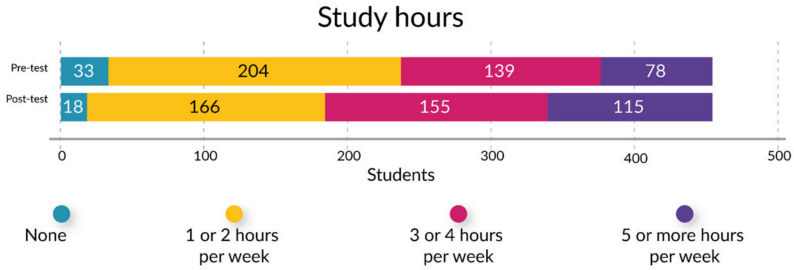

Figure 2. Student study hours.

Professor Focus Group

As mentioned, a focus group was conducted to analyze professors' experiences on the five dimensions guided by questions to emphasize and make clear professors' answers.

The first question was about how professors implemented gamification to set a point of connection and differences. Results on this issue showed a minimal but important variability in gamification, as shown in Table 4. All groups were conducted under the superhero's narrative. Groups had a leaderboard for each evaluation period (partial), so the badges count began again after each period during the semester. This practice allowed professors to make adjustments to their gamified parts of the course, and students had the opportunity to participate and make changes to their strategies.

Table 4. Variability on gamification implementation.

Variable	Professor 1	Professor 2	Professor 3	Professor 4	Professor 5
How can students earn a badge?	Spontaneous class participation. Exams' grade progress.	First place in competitions (Khaoot, Socrative, Jeopardy, etc.), reviews, and extra work.	Badges were not necessarily related to the description. Students had to do extra work to earn badges. Also, class participation counted.	Extra weekly activities. Delivering before the due date. Interesting questions from students. Real and considerable progress from one subject to another.	Extra work. Class participation.
Most popular or given badge	Flash Stark Grut Fantastic 4	Not specified	Spiderman or Superman. Flash. Capitan America.	Flash Ironman	Not specified
Badges exchange	5 points on the exam	10 points for partial (exam)	Maximum 10 points per partial.	Ironman is worth 2 points.	Not specified
Leaderboard socialization	By quintiles. Professor showed the leaderboard in class. Students participated, even on WhatsApp.	Professor showed the leaderboard in class when it was updated.	Professor showed the complete upgraded leaderboard.	Not specified	Professor showed the leaderboard in class.

The professors expressed that students were willing to participate or even do extra activities to have the benefits of their participation on the leaderboard. It is interesting that the most common way to participate was in class but also on already gamified resources such as Kahoot. One of the participant professors combined gamification with Gamit! with the use of class stamps, and students gained badges when they accumulated a set of stamps.

For the professors, there is no doubt about students' motivation in their math class. Table 5 summarizes professors' impressions on this dimension.

Table 5. Dimension: attitudes towards mathematics from the focus group.

Variable	Professors' Perceptions	Comments
Motivation	"More than obvious".	Participation as evidence.
Enjoyment	They both (professors and students) enjoy the class more than before.	Time looks not to pass on class.
Usefulness	Students ask for extra exercises to get badges, but not sure students understand how to apply math in their life.	"I am not sure if it is only gamification, there is a logistics to convince them". "They increasingly manipulate their strategies to have more badges".
Confidence	Students are more confident, among other topics, because they know they have badges.	"It gave them a lot of confidence to see each other and participate".
Anxiety	It has improved in students because they want badges.	"Anxiety has gone up because they are looking for how to climb, but I see it more as giving them that energy to move".
Procrastination	For professors who give badges in class, they do not see a relationship, but the professors who give badges for delivery before the due date have noted lowered procrastination.	"Procrastination has not promoted it". "It gives them badges if they deliver before the date".

2.2.2. Second Question Results

We now address the question: What is the relationship between the Gamification methodology based on a reward mechanic and the attention, engagement, and resilience dimensions on the part of students and professors?

First, the descriptive were calculated, as shown in Figure 3.

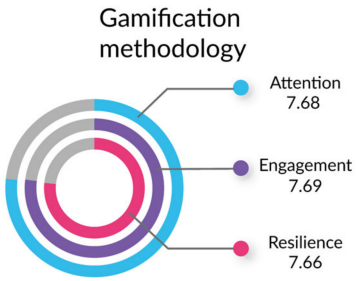

Figure 3. Gamification Methodology Dimensions Mean.

We can see that the mean of the three dimensions was similar, and when the ANOVAS were calculated by categories, no significant differences were found by professor, program, or semester; however, there were differences by gender and scholarship. The results are shown in Table 6.

Table 6. ANOVAS by gender and scholarship.

Categories Dimension	Attention	Engagement	Resilience
Woman-Man	8.2 (2.1),7.3 (2.4), $\propto = 0.001$	8.2 (2.02), 7.3 (2.5), $\propto = 0.001$	8.15 (2.14),7.3 (2.6), $\propto = 0.001$)
No scholarship/scholarship	7.4 (2.5),7.93 (2.2) $\propto = 0.028$		

Students were also asked what kind of emotion they felt when they won a badge, and the answers shown in Figure 4.

Figure 4. Student's emotions.

The emotions of pride, joy, happiness, and motivation were the most voted on, while the words well-being and non-emotion were the least voted on. A recurring comment by students in the open questions was: "The badges allow us to benefit from the points or rewards system while maintaining motivation and healthy competitiveness in the classroom".

Professor Focus Group

On the dimensions of Attention, Engagement, and Resilience, the professors commented on the following during the focus group session.

1. Attention

Professors agreed that students were willing to participate if they saw the benefits of using badges There were cases in which students did not have the enthusiasm professors expected to participate on the leaderboard at the beginning of the course. Surprisingly, students were active in class, even proposing activities to get badges. Professors noticed

increased participation from students who did not participate before. Sometimes professors had to guide students or even ask specific students directly to balance the participation and give badges to everyone by merit. Collaboration also improved; students helped their classmates to climb up the leaderboard. A professor said, and the rest agreed, that students who do not need extra points, are the first to participate, but professors contribute to increasing participation from students who usually do not participate in class. Specifically, professors talked about shy students who were encouraged to participate or help their classmates through this gamification system. As another professor said, "they [students] love the exam improvement badge". For the professor, this is evidence of students' motivation and interest in learning.

2. Engagement

In general, the class environment was nicer and sometimes included laughs. Professors noticed students' positive emotions when they showed the leaderboard. Smiles on students' faces were seen with avatars, badges, and participation. Interestingly, students participated, proposed exercises to get badges, and asked their professors for extra work to get badges, but, moreover, students were attentive to their badge's assignments. Students asked their professors for upgraded ranking positions and demanded to see their badges.

On this dimension, professors were not sure whether students were more engaged with the course or the platform, but they did see differences in quality and an opportunity to reinforce other skills and behavior. Professors asked themselves if they can contribute to more platform engagement by frequently showing the leaderboard in class.

3. Resilience

This dimension was divided into three questions to get a clear idea of how professors interpreted their students' resilience. First, professors expressed that they do not see a clear relation between the use of gamification, Gamit! and resilience, but opinions were different about the idea of getting a badge. These dimension answers are more related to engagement because they only talked of expressions and emotions when students got badges and thought that there are other chances to get badges. One professor specified that she saw students' frustration when they did not earn badges, or expressions of "I made it" when they won. This is why she balanced participation in class, asking students who do not participate on their own. Another professor said his group really enjoyed the competition.

On the other hand, a professor expressed that there can be frustration from not earning a badge, but it is only a game. Other professors said students are getting badges not because of mathematical ability but rather as a result of attitude and participation.

The professors agreed that they can help to promote resilience when it is their turn to populate the leaderboard. However, at first sight, they do not see a relation between resilience and gamification at this time of the semester. They see other skills and behaviors, such as negotiation and improvement.

2.2.3. Third Question Results

We then addressed the final question: What is the perception of the usability of the Gamit! platform by students and professors?

We found that the average grade given by the students was 76.5. A significant difference was found with respect to gender (women 7.9 (1.54), men 7.4 (1.8)) and scholarship (non-scholarship 7.45 (1.73) $\propto = 0.028$, scholarship 7.8 (1.63), $\propto = 0.028$). Students were also asked if they would recommend the Gamit! platform and about usability of the platform, the answers of which are presented in Figure 5.

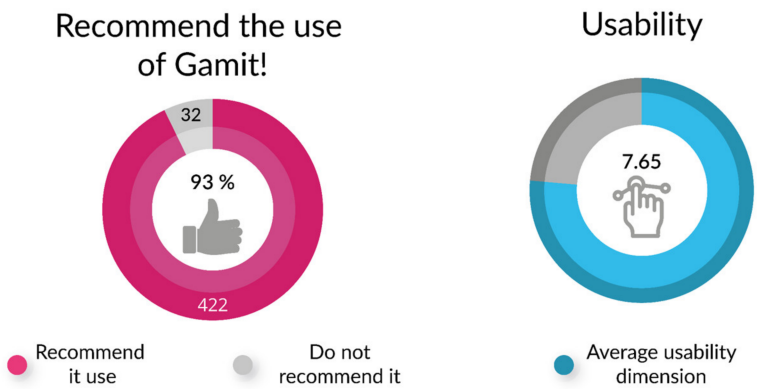

Figure 5. Recommendation and usability (students).

Although students would recommend the Gamit! platform, the average rating given for usability still has room for improvement. Among the most positive aspects of the platform were: "Easy to use and check your progress through the ranking", "The use and personalization of avatars motivates us, allows us to identify ourselves quickly and maintain anonymity" and the least positive were: "Improve the design and view of the interface", "that can be accessed from the cell phone".

Professor Focus Group

This dimension was centered on professors' management of gamification and the platform. But it also involves inquiries about students' satisfaction and the perception that it is easy to use.

In general, professors agreed that the platform use helped them to save time on the administration of gamification. They mainly stressed the fact of saving time when assigning badges and showing the leaderboard to the class. Other features were also mentioned, like the automatic ranking and notifications to students who earned badges.

Visual and design aspects were also valued from students' perceptions and professors' experiences. According to professors, students felt attracted to the Gamit! leaderboard compared with the "manual version". Another benefit they see on this gamified experience is the transparency to students, on how and why they got badges and points, making this gamification satisfactory to professors who feel less stress on managing the reward system and making clear for students why they got (or did not get) a badge.

Functionality suggestions regarded the sense of creating a class and the leaderboards, as well as notifications to students.

3. Discussion

Regarding attitudes towards mathematics, the general results of the students showed that the dimensions in which there was improvement were in anxiety and enjoyment (see Table 1), which were corroborated by the professors (see Table 5). For [22,23], the improvement of anxiety management promotes a better predisposition in the learning of mathematics, and if we add to this an improvement in the level of enjoyment, undoubtedly the performance of the students could improve. In this sense, gamification based on a reward mechanism can promote an improvement in attitudes towards mathematics in terms of anxiety and enjoyment.

However, the motivation and procrastination dimensions decreased in the case of students (see Table 1), while the results of the focus group showed that professors agreed that they saw students motivated since they actively participated and commented that class time passed very quickly (see Table 5). Regarding procrastination, professors noted that there was not much to do with the reward mechanisms since most of them awarded the badges for participation. In this sense, since there is a discrepancy between students and professors regarding the motivation dimension, it would be necessary to find the factors that provoked the results, particularly since the hours of study reported by students at the

end of the course were greater than at the beginning (see Figure 2). In the study [7,37] it was found that one of the most favored dimensions was motivation, so this result is interesting, and perhaps one of the reasons is that new professors were incorporated in this study.

The relationship of the gamification methodology based on the mechanisms of rewards with respect to the dimensions of attention and engagement were evaluated at almost 77 out of 100 (see Figure 3), and it was found that women and scholarship students rated these dimensions better than men and non-scholarship students (see Table 6). In the focus group, the professors were enthusiastic about gamification and agreed that the students were attentive, participatory, engaged, and manifesting positive emotions. These results coincide with those found in [5,6,11,38,39], in which it is stated that gamification favors attention and engagement. In this sense, gamification based on a reward mechanic and managed by the dynamic platform Gamit! improves attention and engagement in high school mathematics courses.

Finally, regarding the usability of Gamit!, 93% of students said they would recommend it, although with respect to the usability of the platform they gave a rating of 76.5% (see Figure 5), which invites improvement. In addition, the result is encouraging, and several studies indicate that the speed of the learning curve at the beginning of any technology is slower given the resistance to change, but then it improves over time [40,41]. On the other hand, from the professors' perspective, they consider that the platform helps them save time in the management of gamification and that Gamit! allows the allocation of extra points that they made before adopting gamification to be clearer and more fun for students. In this sense, Gamit! [42] is a tool that facilitates the management of gamification for professors, although like all technology it is perfectible and requires time to be adopted.

4. Conclusions

From the results of this study, we found that gamification based on a reward mechanism can improve high school students' attitudes towards mathematics, particularly in the dimensions of anxiety and enjoyment. We believe that offering tools within the classroom that help students manage their anxiety about the teaching-learning process can contribute to the benefit of their learning and perhaps in the selection of their professional career. With respect to the motivation dimension that presented a significant unfavorable difference from the students, it invites us to reflect on the relationship between the use of didactic strategies such as gamification and a good teaching-learning process of the math course contents, as well as the meta-evaluation of the strategies applied in the classroom.

Although students perceive the relationship between gamification based on a reward mechanism, and the attention and engagement dimensions as good, professors perceive themselves as being more enthusiastic since they notice that since the gamification of their classes, students have become more participatory, attentive, and even suggest activities to earn badges. They also highlight that the reward mechanism promotes inclusion, since the badges recognize distinct aspects (cognitive, attitudinal, skills and values). Regarding the Gamit! platform, the professors agreed that it facilitates the management of gamification since it saves time and makes it clear to students about the extra points earned.

Finally, the results of the study show that gamification based on a reward mechanic managed by a dynamic platform (Gamit!) favors the learning environment in high school mathematics courses. However, it would be interesting to investigate its effect on learning. On the other hand, there is the possibility of applying the gamification methodology of this study in other disciplines and at other educational levels, always considering that it is a strategy that accompanies a good teaching-learning process and that perhaps gamification is only compatible with those professors who take their teaching practice further.

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E.G.R.-F., B.N.S.-G., L.M.-C. and N.K.R.-R.; visualization, E.G.R.-F., B.N.S.-G. and L.M.-C.; supervision, E.G.R.-F.; project administration, E.G.R.-F., B.N.S.-G., L.M.-C., N.K.R.-R., H.A.Q.-C. and A.M.-S. All authors have read and agreed to the published version of the manuscript.

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Gamit! Interactive platform for gamification

***Abstract*—Gamit! is a software platform that enables instructors to use gamification concepts and techniques in their classrooms. Currently, the platform allows instructors to create leaderboards and use badges to incentivize students in the pursuit of learning. The results during a user experience testing phase (one university academic term) using the System Usability Scale, showed that the platform is easy to use, and the functionalities work correctly.**

Keywords— Web Platform, Rewards Mechanics, Educational Innovation, Higher Education

I. INTRODUCTION

Based on various studies, it has been shown that didactic strategies such as Gamification based on a reward mechanic, promote motivation and attention generating greater commitment by students, which allows them to achieve learning objectives satisfactorily. However, the management of a reward mechanic done manually or in Excel (without a software system) can result in a greater workload for teachers, therefore, a web platform is required that allows teachers to apply gamification optimally and dynamically. To facilitate the management of Gamification based on rewards mechanics for teachers, and at the same time, that it is visible and dynamic to students, a team of teachers from two Latin American universities in Mexico and Peru developed a web platform for Gamification called Gamit!

Gamit! allows teacher users to design their leaderboards and badges but also offers predetermined boards and badges, in addition, each badge is linked to a knowledge competency. Students can see how many, and which badges they have won, as well as their position on the leaderboard, and receive notifications via email.

II. THEORETICAL FRAMEWORK

A. Leaderboards, avatars, and badges

Gamification is commonly applied in education and workplaces because of its effects on motivation and performance according to the most used definition that stresses the use of game elements on non-game scenarios [1]. Authors [2,3] study the different effects to understand and determine if gamification plays an important role in motivation, skills reinforcement, and knowledge. Gamification on education uses game mechanics such as leaderboards that are filled and updated with avatars and badges [4]. Badges work as a mechanism to improve motivation with an achievement meaning [5] that works as an opportunity to reward students who are involved with learning and complete the set rules of the game. Anonymous participation is optional; however, anonymity is recommended for gamification mechanics and playful experience to set a secure and confident learning environment attached to surprise and expectation. Avatars are a digital self-representation [6] that students choose to be seen on the leaderboard. Avatars are a helpful solution to encourage students to participate because even if they fail on the gamified course structure, no one will point them out, so they can do tasks at their own pace or way without being exposed when there is a mistake or misunderstanding, reducing insecurity [7].

Leaderboards integrate some of the game elements, show students' progress [2], and show group advancements on performance or specific skills according to the narrative used on the gamified design. There are different ways to present a leaderboard, but the basic idea is summarized and present the group score, positions, points, badges, and the gamified experience [3] on a visual board.

Huang, B., & Hew, K. F [8] studied the gamification effects on different research and how it impacts performance, socialization, and knowledge. They recommend following a design model, first to choose the narrative and game elements for each context but also measure impact on different moments and as a result of the iterative design process to understand the effect of each gamified element and how they affect each part of the learning process. This need represents an extra effort to teachers, academics, and researchers to implement gamification and analyze their results.

B. System Usability Scale Questionnaire

To measure the quality of the user experience when students interact with Gamit! We looked for a tool that was easy and simple to apply to students. It was decided on the SUS (System Usability Scale) tool, developed by Jhon Brooke in 1986. This has been used for several years as an industry standard and allowed us to measure usability quite quickly and in a reliable way[9,10]. It consists of a questionnaire made up of ten questions that are scored using a Likert scale (from 1 to 5), expressing whether they totally disagree or totally agree with the statement[11]. The responses are extrapolated to obtain a score that determines the level of usability of the system. Among the advantages of using this tool are that it is very easy to administer since there are only 10 questions and it is a low-cost tool. The disadvantage is that it gives a global result and does not delve into specific functions of the system.

III. METHODOLOGY

The approach was mixed of the QUAN-qual type, that is, the quantitative predominated and was complemented with qualitative information [12], the study was descriptive and exploratory. The sample was composed of 25 students, who participated in the pilot study and answered the SUS (System Usability Scale) instrument. The Gamit! was applied during the academic term from September to December 2022 in one Mexican university to students of the economics and social sciences careers of the course Mathematical Thinking I, whose contents correspond to pre-calculus and differential calculus. Gamit! It is based on the mechanics of rewards and as components have badges, leadership boards, and avatars. For the piloting of the platform, seven badges were

established, each corresponding to an attitude, skill, or value. The rewards were given for outstanding participation, for good collaborative work, for helping a colleague, for improving from one evaluation to another, for outstanding performance in an exam or activity, for good discipline, and also, a badge was contemplated that eliminated the others when the student incurred in an academic lack. Each badge was worth one point and the student could redeem a maximum of 10 points in each partial exam, which had a weighting of 10% of the partial grade (grade out of 100). On the Gamit platform, students could see their ranking as well as the number of badges and points earned, see Figure 1.

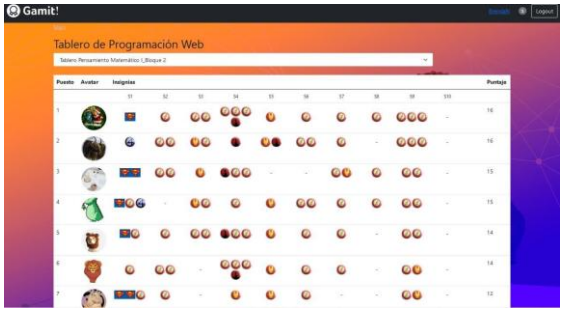

Figure 1. The leaderboard in the Gamit platform.

In Figure 1, you can see in the first column the avatars and in each next column the badges and points earned by the student. The objective of the study was to know the level of usability of the platform from the perspective of the student, for this the SUS questionnaire (System Usability Scale) was applied, which contains 10 questions with a Likert scale.

IV. RESULTS

Below are the results on the frequencies of views and the place where the leaderboard was consulted by the students. Then the results of each question of the instrument are presented, and finally, the most outstanding open answers about the students' opinion respect Gamit.

Figure 2 shows the number of times the platform was consulted by students.

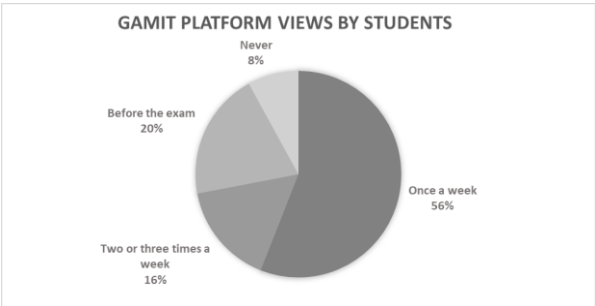

Figure 2. Gamit platform views by students.

The results show that students mostly consulted the platform once a week. The result is positive given that when the platform did not exist, students consulted the board before the exam.

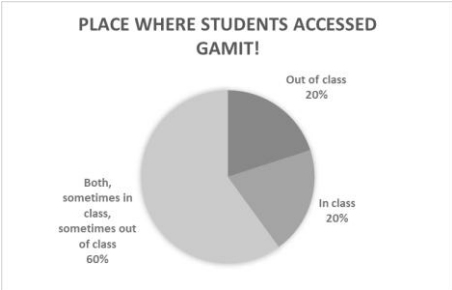

Figure 3. Place where students accessed Gamit!

In Figure 3 we can see that most of the students consulted the board sometimes in class, sometimes outside the class. This result could indicate that the platform has quick access. Concerning the results of the SUS instrument, we can see in Figure 4 that the results are favorable. It emphasizes that the platform is easy to use and that the functionalities work correctly.

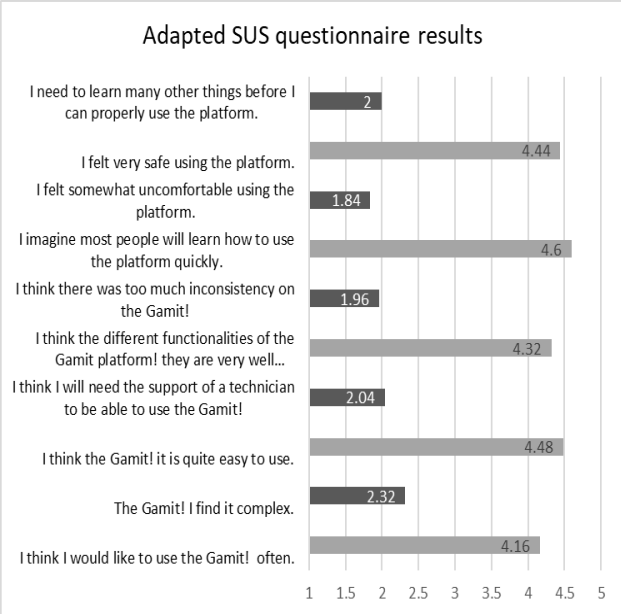

Figure 4. SUS questionnaire results.

Finally, in Table 1, you can see some outstanding answers about the opinion of students regarding the Gamit! platform.

TABLE 1. OPEN QUESTION ANSWERS

Student	What is the best thing about the Gamit! platform?
1	It is easy to use and dynamic
2	Use custom avatars
3	That you can see if you had a breakthrough, that it's anonymous and you can't feel bad if you go too low
4	I think the platform helps to deploy reward information in a clear and organized way. That for me is a very positive thing.
5	It's best to be able to observe the points on the board because I can observe my progress.

V. CONCLUSION

Gamit! is a web platform that was created through collaborative work from two Latin American universities in

Mexico and Peru to facilitate the teacher management of gamification based on rewards mechanics. Besides aiming to improve student engagement with their classes through Gamit!, the benefits of the web application are that students can view the rewards they accumulate as well as and their position on the leaderboards through anonymous avatars, all in real-time. The study results reveal that this first release of Gamit! has proven to have a straightforward user experience for the students, which allows the Gamit! team to continue expanding its use with more teachers in diverse subjects.

Future research could address to study the user experience from the teachers' perspective as well as the impact of the use of Gamit! in regards to student in-class engagement and learning.

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HALL IMMERSIVE ROOM + GAMIFICATION: A GREAT LEARNING EXPERIENCE!

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Abstract

Hall Immersive Room (HIR) is an immersive classroom, designed for the delivery and transmission of virtual courses that, with the integration of video, communication, and interaction technology, break the barriers of distance and improve the relationship between students and teacher, favoring verbal and non-verbal communication of the participants and facilitates high proximity of the teacher with his students in an immersive environment. Gamification based on a reward mechanism contributes to increasing these interactions. This study aims to show how Gamification based on reward mechanics promoted engagement and attention in the HIR modality and in a Matrix Modeling course for Engineering students. The course was made up of 96 students from different geographical locations, the teaching professor, four assistant professors who were in charge of reviewing the activities, tasks, and exams, as well as the production team and academic assistants who observed the class with the aim of giving feedback for improvement. The methodological approach was concurrent mixed, in which qualitative information complemented quantitative information, and vice versa. Among the results obtained are students' sustained participation during the course, an improvement in the task's quality, and assignments done during the course. Students' experience was more immersive and enjoyable compared to other classes without these practices.

Keywords: Higher education, Educative Innovation, Educational Gamification, Immersive Education.

1 INTRODUCTION

In response to the need to optimize distance educational experiences, favoring the interaction of students and professors, and joining other top institutions, in the creation of spaces to generate virtual sessions with immersive experiences, in May 2021, the Tecnologico of Monterrey began teaching classes in the Hall Immersive Room (HIR). The classroom is a space where synchronous sessions can be conducted by videoconference, the professor interacts with remote students living a unique experience thanks to the panoramic view in many monitors that favor the creation of an immersive environment.

The HIR modality emerged to offer a different learning experience in which students from different geographical locations could converge in the same class. The courses given in this type of classroom are taught by outstanding professors in their discipline applying various didactic resources to promote active learning.

From May 2021 to June 2023, 169 professors from 124 professional and postgraduate training units participated, impacting more than 11 thousand undergraduate and postgraduate students from the 26 campuses of the Tecnologico de Monterrey and continuing education students. Also, more than 600 students from universities in Austria, France, Germany, Spain, the United States, Colombia, Switzerland, Nigeria, India, Israel, Japan, Australia, Canada, Sweden, and partner educational institutions of Tecnologico de Monterrey, have participated.

2 LITERATURE REVIEW

2.1 Massive Courses

A mass course is aimed at many participants, but there is no accepted definition of what a large class is. Empirical studies in this area tend to draw evidence from classes with more than 100 students [1]. In the Hall Immersive room (HIR) the groups vary from 100 and 300 students per class.

On the other hand, [2] illustrates that technology is utilized as a mainstream element in the delivery of higher education programs that can provide systems for managing learning settings while offering students choices and opportunities to undertake learning suited to their own needs. As a result of the advances in technology applied in education to facilitate mass participation of students and provide greater accessibility to flexible education, the experience of HIR as an immersive classroom is developing positive emotions in professors, increasing motivation and satisfaction towards learning.

To make the students feel that they are not at a distance, the professor can move around the room staring at the intelligent cameras that bring him closer to the students, who are projected on the different monitors, which improves the relationship between students and professor, and encourage verbal and non-verbal communication in the classroom. Professors show positive emotions by seeing their students' faces as if they were present in the classroom, allowing them to detect if the topics presented were understood or if they need to create an interaction to reinforce them, observing the degree of engagement of the group.

Unlike the use of a traditional videoconferencing tool, one of the advantages of the eye contact generated with the HIR technology is that the fact that professors can see the students in real size generates a click on the brain, which when interacting with them in real-time, creates what the experts call "state of flow" and achieve immersion. They say that breaking the barrier of distance by feeling their professor present, takes the students into a state of flow that ranges from Enjoyment, Curiosity, and Challenge to Concentration [3]. Students eliminate their fears, anxieties, and insecurities, increasing their social-emotional health.

This immersion is achieved thanks to the placement of 27 screens of 55 inches each one in a half-moon format, creating a high-definition video wall that offers a panoramic view as well as integrating cameras, lighting, and a high-fidelity sound system (see Figure 1).

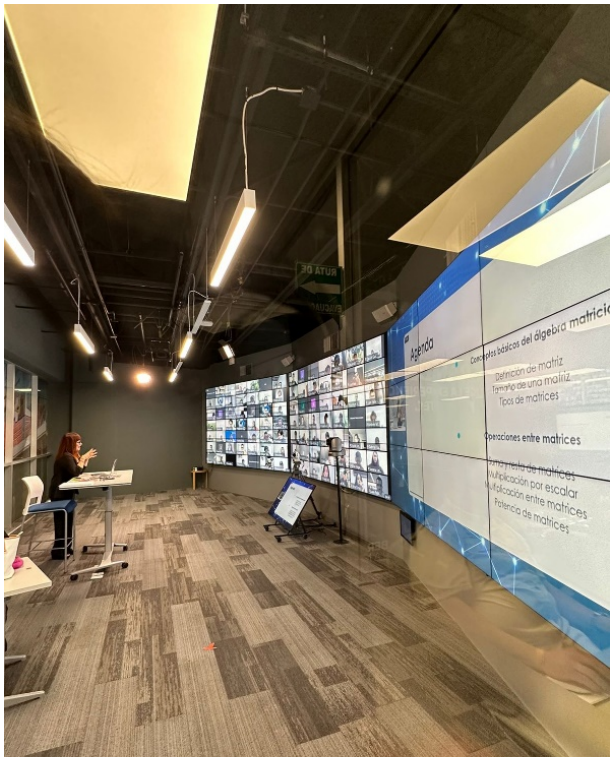

Figure 1. Matrix Modeling course in HIR modality.

Another differentiator of the HIR room is the delivery model, promoting active learning which, according to the National Survey of Student Engagement (NSSE) [4] involves the efforts of the students to actively build their knowledge by working with other students on projects, presentations, and discussions during class, in an environment of collaboration and support.

When students are periodically given, something related to the course to do during class, positive interactions are promoted, attention to the teacher is increased, and spontaneous student participation is stimulated, causing engagement, a key indicator for high-quality teaching.

2.2 Gamification

Games are commonly seen as entertainer trainers, but they contribute as learning boosters. This is why its application in education is becoming more frequent and considered one of the six active learning trends [5]. Gamification implies the use of game elements in non-game contexts [6], moreover, in education, it strikes a selective choice of game elements [7] to integrate them into courses and assignments, it points to the outcome or the process [8].

Humans who feel comfortable, safe, and pleasured, diminish stress and mental blocks associated with learning, thus, as is known, the environment is crucial for learning. Gamification contributes to an attractive learning environment in which, indeed, students can learn and feel the flow [9]. Studies show gamification is worthy for all subjects from language, physics [10], business [8], math [11], chemistry [12], etc.

Authors such as McGonigal and Gee address people who learn through games because there is a lack of consequence since try and failure [13], [14] are part of the game experience. Incompetence is acceptable in playing, people want to master some games, not necessarily on subjects, this sensation contributes to creating engagement on the topic as well as the satisfaction related to winning [15]. Active learning and games share user-student-centered designs and processes. Active learning implies thinking and reflection, but knowledge application is oriented to less structured problem situations such as daily context [16] because of the interactions expressed as communication of ideas, conceptions, and reflections [17]. Performance improves because of motivation and progression on goals [18].

The game elements are usually integrated to improve learning responses to models such as Werbach and Hunter's. This kind of model requires mechanics, dynamics, and components [19]. Mechanics can be considered as part of the participation sequence to get the benefits of the game in each course context. Dynamics are the design principles that are vital to setting the actions (mechanics) and choosing the adequate action structures (mechanics), while the interface may be the components [20].

Anyway, mechanics are the fundamental rules and systems, elements are the pieces that make the game fun and engaging, and components are the deeper aspects that shape the overall experience. Gamification in education uses these concepts to enhance student motivation and engagement in the learning process. Levels and points are the most widely used mechanics, as well as rewards.

Academics pay special attention to rewards meaning that students can receive virtual badges or medals for specific achievements. For example, earn a badge for completing all lessons in a unit of study. Rewards also serve as feedback and motivators, students who get a reward, gain self-confidence, improve their self-concept, and want to do more activities to get more rewards [21].

Leaderboards are an effective tool to show progress and socialize gamification with the class. They are visual tools that display and rank the performance of students or participants in the course game or activity. These boards are used to encourage healthy competition, motivate students, and reward success and achievements. Usually, leaderboards display students in a specific order according to their performance.

On the other hand, when someone is forced to play, fun and some gamification benefits are lost. Thus, participation in gamification is voluntary, and anonymity is desirable. Avatars are visual representations [22] to keep anonymity during games, therefore, leaderboards can show avatars instead of students' names or numbers. Using avatars helps students not to feel exposed especially if they do not get enough badges.

Narrative is another element of the game that especially frames gamification [23]. As part of the game experience, the problem involved is mandatory, otherwise, the assignment will be only a playing moment without academic purpose, or just academic work [24]. The challenge level must be appropriate to students to keep them motivated and engaged; however, a fascinating narrative does its part. The narrative must be familiar to students and captivating to make students want to play.

Friendly competition can stimulate performance and commitment. This is why the design should be carefully chosen and balanced according to the learning objectives. It should not be forgotten that gamification is a support tool for students to learn and not the purpose.

3 METHODOLOGY

This study aims to show how Gamification based on reward mechanics promoted engagement and attention in the HIR modality and in a Matrix Modeling course for Engineering students. HIR modality represents a challenge for instructors because they must promote motivation and engagement and develop an immersive environment while at the same time teaching and attending to student's doubts. For this reason, this study was carried out, and its purpose was to determine how Gamification based on a reward mechanism favors motivation and engagement and promotes an immersive environment.

The course was made up of 96 students from different geographical locations, the teaching professor, who taught the contents, designed tasks, and activities for class, and led the Gamification. The teacher was assisted by four professors who reviewed the activities, tasks, and exams, as well as the production team and academic assistants who observed the class with the aim of giving feedback for improvement. The reward mechanics were based on badges, avatars, and a leadership board. Each badge acknowledges some aspect of the student, such as outstanding participation, collaborative work, or outstanding performance. Figure 2 shows a part of the course leaderboard.

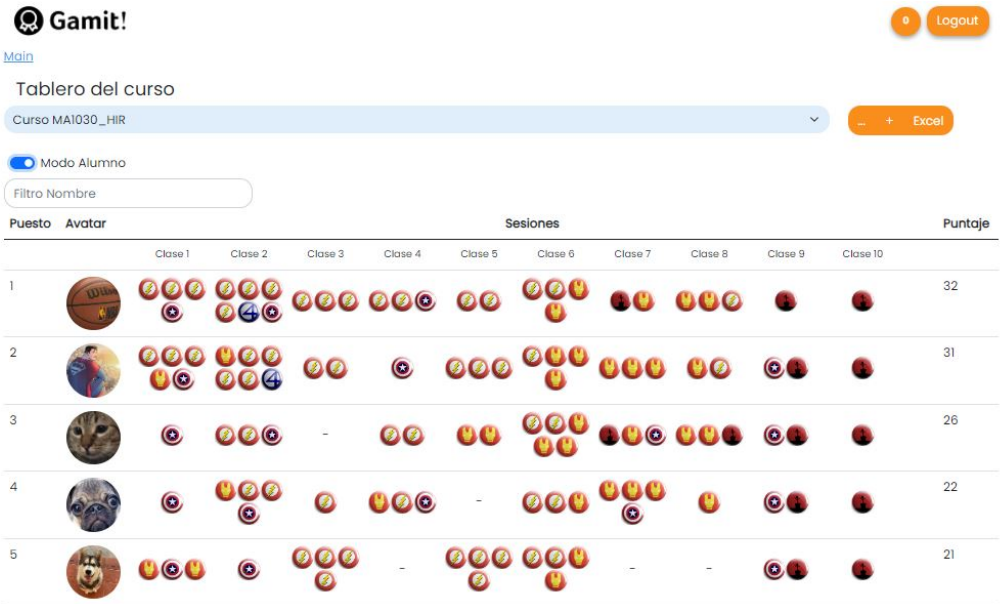

Figure 2. Leaderboard (Gamit!) in student view.

In the leaderboard, the teacher assigns badges to students, while students select and upload their avatar, they can see the badges earned and their ranking.

To collect data an instrument with a scale Likert and continuous was launched (0 for strongly disagree, 100 for strongly agree), the dimensions were: Active Participation, Attention, Quality in Activities, Confidence, and Enjoyment. The instrument was responded to by 66 students at the end of the course. In addition, the academic assistants were interviewed who observed several classes in the HIR modality.

4 RESULTS

The results of the instrument and the interview are presented below.

4.1 Students Results

The questionnaire was answered by 48 men and 18 women, of whom 60% have scholarships. Figure 3 shows the distribution of their ages.

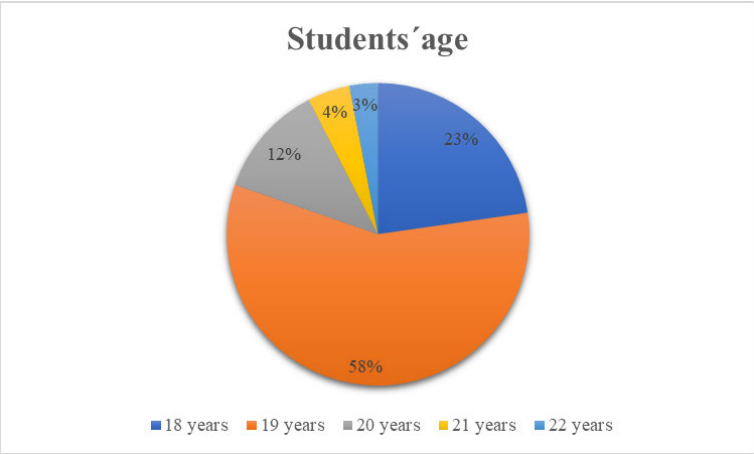

Figure 3. Students' age distribution.

Figure 3 shows that the age of most students was between 18 and 19 years old. Students were also asked each time when reviewing the Gamit! leaderboard, the distribution is shown in Figure 4.

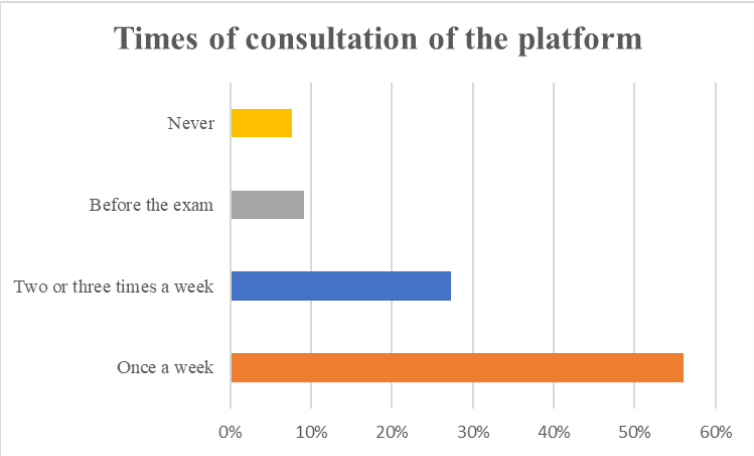

Figure 4. Times of consultation of the platform.

As shown in Figure 4, most students consulted the Gamit! once a week followed by two or three times a week, which shows an interest on the part of the students. Regarding the dimensions, the results are shown in Table 1. The scale goes from 0 to 100.

Table 1. Grade´s dimensions.

Dimensions	*Grade*
Active participation	80.2
Attention	80.9
Quality in activities	82.0
Confidence	73.8
Enjoyment	76.4

Based on the results of Table 1, Gamification based on reward mechanics in HIR modality favored mostly the dimensions: Active participation, Attention, and Quality in activities, since these had the highest ratings.

Students were also asked what emotions they felt when they won a badge, the results are shown in Figure 5.

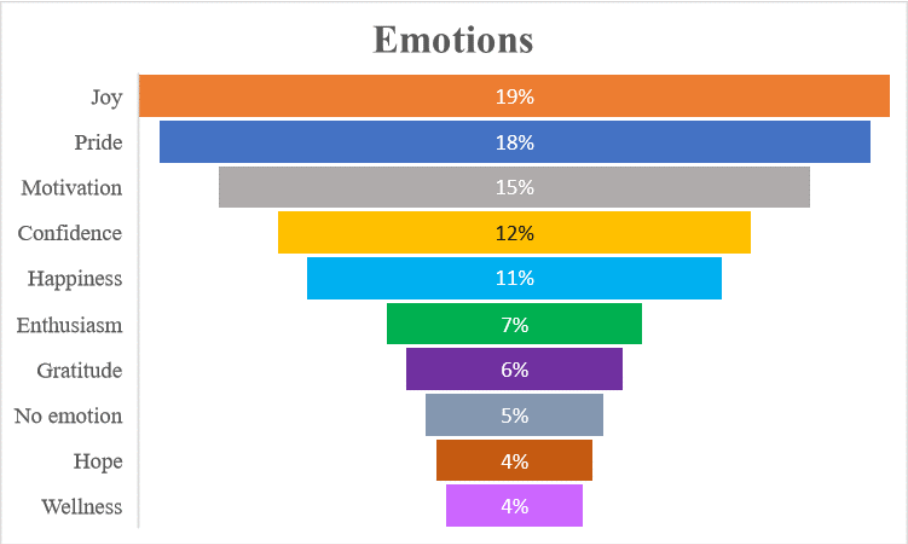

Figure 5. Students' emotions.

The students' emotions that showed the highest frequency were enjoyment, pride, motivation, confidence, and happiness. This is consistent with the evaluation of dimensions. Finally, with respect to grades, the group's average was 84.9, the scale is on base 100, with a passing grade greater than or equal to 70. In addition, the pass rate was 91%.

4.2 Interview

The person interviewed is a tutor with extensive experience in HIR classes, both as a full professor and as an assistant professor. In this course's case, her role was a supportive assistant for the professor and observer, hence her experience as a Professional and Digital Experience Team member, observations, and reflections on this gamified HIR class are considered.

From the point of view of the assistant, the gamification approach was introduced with a clear explanation of participation mechanics and the rewards system, prominently displayed on a leaderboard. As she described, several types of badges recognized and incentivized student achievements. For instance, the "Flash" badge was for the first respondent, while a "Thanos" badge was reserved for cases of academic dishonesty, resulting in the deduction of points and the removal of other badges. Additionally, badges acknowledged outstanding assignments and active class participation. The occasional integration of gamified platforms such as Kahoot further enriched the learning experience.

As mentioned by the interviewee, in the context of the HIR environment, organizing student participation on screens requires careful coordination. When students raised their hands, their screens were arranged from left to right. However, for an instructor handling multiple screens simultaneously, keeping track of who wished to participate presented challenges. In cases where students did not raise their hands or use Zoom reactions, additional support was needed to assist the instructor in identifying potential participants, often relying on chat interactions.

From the instructor's perspective, managing gamification in a class with over one hundred students posed its own set of challenges, particularly in terms of record-keeping. The interviewee acknowledged the efficacy of various badge categories but emphasized the importance of inclusivity. There was a call for badges that catered to all types of students, including those who may not be quick to respond or technologically oriented.

Remarkably, students exhibited an important level of motivation in this gamified HIR course, defying the challenges typically associated with remote learning. Active student participation during class discussions and a keen focus on earning badges were significant outcomes. Notably, camera usage issues, often prevalent in other HIR courses, were not a concern in this class in which students earned badges.

5 CONCLUSION

Hall Immersive Room (HIR) classes, characterized by large groups, extensive screens, monitors, and the assistance of support teams for the teaching professor, present a significant challenge in maintaining

student engagement. Likewise, the nature of the online modality leads to occasional feelings of loneliness and isolation among students. It is precisely for this reason that we must seek alternatives to mitigate and prevent the sensation of disconnection from the environment and going unnoticed within the group when learning, so the integration of gamification in this specific educational setting has shown promise in enhancing the overall learning experience although interaction and communication challenges.

Feedback from both students and the support team highlighted the pivotal role of gamification in fostering participation. This gamification approach led to a notable increase in participation frequency compared to other HIR courses. One recommendation was the incorporation of roulette wheels to randomize participation, mitigating the tendency for the same individuals to consistently participate and win badges, thereby addressing an inherent challenge in gamification within HIR classes.

In conclusion, our study underscores the potential of gamification as an effective tool for enhancing engagement and participation in HIR classes. It highlights the need for careful planning and support infrastructure to ensure its successful implementation in large-scale educational settings. The findings demonstrate the significance of gamification in fostering a more interactive and engaging remote learning environment.

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La plataforma Gamit! se desarrolló a través de un proceso metódico y cuidadoso. Inicialmente se creó un prototipo de Gamit! utilizando el software Justinmind. Lo que permitió realizar pruebas rápidas para comprender cómo funcionaría la plataforma y qué ajustes serían necesarios antes de avanzar a la etapa de programación. Durante esta fase, también se definieron los elementos gráficos como colores y tipografías, asegurando que cumplan con los requisitos institucionales tanto del Tecnológico de Monterrey como de la Universidad de Lima. El resultado es una combinación de colores azul y naranja que son emblemáticos de estas instituciones educativas.

Una vez completada la fase de prototipado, se realizó la implementación técnica de la plataforma. En términos de gestión del desarrollo de software, adoptamos una metodología ágil, específicamente el marco de trabajo Scrum. El avance incremental se realizó mediante sprints.

Simultáneamente, se realizó la definición de la arquitectura del software. Desde el principio, se ha considerado la creación de una plataforma escalable, capaz de gestionar a un gran número de usuarios, y que pueda ser utilizada por personas de diferentes regiones geográficas, en particular, México y Perú en un primer momento. Con este objetivo en mente, la arquitectura está orientada a microservicios, lo que proporciona la flexibilidad necesaria para cumplir con estos requerimientos. El código consta de los siguientes módulos:

- Aplicativo web de docentes / Alumnos
- Módulo de servicios de backend
- Base de datos Postgresql
- Aplicativo móvil Android
- Aplicativo móvil iOS

Gamit! se concibe como una plataforma versátil y escalable que satisface las necesidades de usuarios en distintas regiones, ofreciendo una experiencia educativa de alta calidad.

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Chapter 14
The Impact of Gamified Learning With Kahoot! on Student Motivation and Engagement

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ABSTRACT

This study investigates the effectiveness of gamified learning tools like Kahoot! within a Chinese educational setting, aiming to bridge the research gap in non-Western contexts. Utilizing a pre-test and post-test experimental and control group design with 100 students and employing mixed methods for data collection and analysis, including surveys and semi-structured interviews, the authors found Kahoot! significantly boosts student motivation and engagement. Despite these positive outcomes, challenges such as technological access and engagement disparities were observed. These findings offer evidence-based insights for educators to refine gamification strategies, enhancing learning experiences and outcomes. This research provides valuable guidance for effectively implementing gamified learning tools in non-Western educational contexts.

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INTRODUCTION

The digital revolution has led to significant challenges in modern education, including issues related to student motivation and engagement (Lee & Hammer, 2011; Kumar & Khurana, 2012). This challenge becomes even more pronounced in higher education settings, particularly in large classes with limited opportunities for interaction (Wang & Tahir, 2020). Traditional methods have proven to be inadequate (Barata et al., 2015; Bell, 2014; Buckley & Doyle, 2016; Erhel & Jamet, 2013; Hamari & Koivisto, 2014; Jui et al., 2011; Karp, 2012; Montean, 2011; Zichermann & Cunningham, 2011), prompting the need for innovative solutions. Over the past two decades, gamification has gained popularity in education owing to its potential to enhance student engagement and academic performance (Luo, 2022; Sanchez et al., 2020).

Gamification is the process of integrating game design elements (such as leaderboards and points) and features (such as assessments and challenges) into non-game settings to achieve positive outcomes, such as improved learning. Studies have shown that gamification can be an effective educational tool (Deterding et al., 2011; Bedwell et al., 2012; Sanchez et al., 2020). One popular gamification platform used in education is Kahoot!. Originally created in 2012, Kahoot! is a game-based student response system that transforms the classroom experience into an engaging game show. With over 70 million active users per month and 50% of K-12 students in the US using it, Kahoot! has become one of the most popular game-based learning platforms (Lunden, 2018). It has a global reach, with over 2.5 billion players in 200 countries (Vick, 2019). However, some researchers have questioned its effectiveness as an educational tool (Zhang & Yu, 2021), and it is not widely used in non-Western countries, particularly China.

In parallel, studies investigating the impact of gamification on student performance in various educational contexts have yielded inconclusive findings (Fuster-Guilló et al., 2019). Therefore, there is a pressing need for further empirical research to ascertain gamification's true effectiveness, benefits, and drawbacks, especially in the context of platforms like Kahoot! understanding the implications of gamification on student motivation and engagement is vital for educators seeking evidence-based approaches to enhance the learning experience and achieve positive educational outcomes.

This paper makes an important contribution in several ways. First, it provides a comprehensive discussion of gamified learning through synthesizing the literature and how it differs from game-based learning. In particular, the article delves into four key game elements and the potential impact of gamified learning on learning engagement and motivation. In addition, the article provides a detailed description of the Kahoot! Platform, emphasizing its positive impact on learning engagement and motivation. Second, this study conducted an empirical assessment to verify the actual impact of Kahoot! The platform on student motivation and learning engagement. Through interviews with students and teachers, particularly in Chinese animation courses, we further validated the effectiveness of Kahoot! and identified its potential benefits and limitations.

LITERATURE REVIEW

Gamified Learning

Introduction to the Gamified Learning

The scientific definition of gamification entails systematically applying game elements within non-game contexts (Deterding et al.,2011; Zimmerling, 2019; Schöbel et al., 2020; Zainuddin et al., 2020).

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Gamification in the context of learning can be called gamified learning (Armstrong & Landers 2017). While some literature overlaps gamified and game-based learning, they differ fundamentally in their approaches to education(Sailer & Homner, 2020). Game-based learning involves using complete serious games as educational products (Deterding et al., 2011). In contrast, gamified learning enhances existing learning processes by incorporating game elements to create a game-like user experience (Landers et al.,2018). The two concepts aim to add value beyond entertainment but achieve it through distinct methodologies. Gamified learning is not a standalone product but rather an integration of game elements into the learning process (Deterding et al., 2011; Landers et al.,2018), making it an essential distinction between the two approaches.

The exploration of gamified learning within educational settings has garnered notable attention for its potential to revolutionize student engagement, motivation, and learning outcomes. Foundational studies, such as those by Dicheva et al. (2015), provide a systematic overview of gamification's integration into education, underlining its diverse applications and the emerging practices that enhance learning experiences. This body of work lays the groundwork for understanding how game elements, when embedded into educational processes, can leverage the motivational aspects of games to create interactive and engaging learning environments.

Advancements in technology further enrich gamified learning's potential. For instance, Lampropoulos et al. (2022) research into combining gamification with augmented reality (AR) presents a multidimensional approach that significantly benefits students and aids educators in adopting technologically enhanced learning environments. Such integrations point towards creating immersive educational experiences that exceed traditional learning modalities. Concurrently, the resilience of gamified learning, as observed by Chen et al. (2023). during the pandemic, emphasizes its capacity to maintain student engagement through remote synchronous teaching, even under challenging circumstances.

Personalization in gamified learning, advocated by Oliveira et al. (2023), introduces "tailored gamification," which suggests adapting game elements to individual learner preferences and needs, thus enhancing the specificity and effectiveness of educational experiences. This approach is echoed in studies across various educational levels and disciplines, from Kam & Umar's (2023) findings on non-graded learning activities bolstering autonomy and intrinsic motivation to Pham's evidence of its effectiveness in ESL grammar achievement.

The empirical evidence collectively underscores the broad impact of gamified learning. It has been shown to improve cognitive, affective, and behavioral learning outcomes, with notable enhancements in motivation, engagement, and academic achievement across various fields, including STEM, ESL, and language acquisition (Alam et al., 2023; Chugh & Turnbull, 2023; Dehghanzadeh et al., 2024; Kabilan et al., 2023; Qiao et al., 2023; Yu & Yu, 2023). The adaptability of gamified learning to cater to diverse educational needs and its ability to foster a competitive yet collaborative learning atmosphere highlight its transformative potential in educational paradigms, offering a promising avenue for future educational innovations and research.

Gamified Learning in China

With its rich educational history and rapid technological advancements, China provides a unique landscape for exploring the potential and challenges of gamified learning. A study by Luo et al. (2021) investigated the factors influencing the acceptance of gamified learning tools among secondary school teachers in China. Their investigation sheds light on the motivations and barriers to the adoption of gamification in

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formal learning contexts. Understanding these factors is crucial for designing effective gamified learning environments that meet the needs of both educators and students. Chen et al. (2020) explored the design of educational games under the Maker Education Concept by investigating the 'Happy Tour China' game. Their analysis focused on four key aspects: game protagonist, story, mechanism, and feedback, offering valuable insights for future educational game designers to enhance learning experiences while fostering creativity and engagement among middle school students. Moreover, gamification of the learning environment has engaged students and enhanced their academic performance and commitment to sustainable learning, as Ng & Lo's (2022) research on flipped classroom models augmented with gamification techniques during the COVID-19 pandemic. In language learning, gamified strategies have also shown promising results. Mei & Yang's (2019) exploration of mobile augmented reality (AR) and gamification in environmental education highlights the potential for incorporating technology-enhanced, gamified content into language learning processes. This approach engages students and seamlessly integrates environmental education into their learning journey, illustrating the versatility of gamified learning in various educational contexts. At the tertiary level, Lv (2023) conducted a pilot study to evaluate the impact of a gamified learning environment on college students' engagement and motivation in China. The findings underscore the significant role that gamified elements play in enhancing student involvement and enthusiasm for learning, pointing to a broader application of gamification strategies across different levels of education. There is a positive trend in the development of gamification in China's growing education sector.

Effects of Gamified Learning on Motivation and Engagement

Recent empirical investigations have been conducted to validate the effectiveness of gamified learning, particularly focusing on its potential to boost motivation and enhance engagement in the learning process (Domínguez, 2013; Zainuddin et al., 2020). For example, Rincon-Flores and Santos-Guevara (2021) observed that gamification effectively stimulated students to actively participate and improve their academic performance in diverse instructional settings, including distance, synchronous, and online modes, specifically in courses like Calculus and Lateral Competency Development. Echoing this sentiment, Chans and Portuguez Castro (2021) reported similar findings in their research, which explored gamification's impact on students in chemistry classes, highlighting its positive influence on motivation and engagement.

However, it is important to note that implementing a gamified approach requires careful design to balance the academic workload and the enjoyment factor within the course (Killam, 2021). Furthermore, the system must be designed to allocate points and distribute badges to students (Imran, 2019). This approach may only be universally suitable for some courses and should be thoughtfully adapted based on course content and objectives (Leung et al., 2023).

Moreover, findings from Sanchez et al.'s (2020) experiment have raised certain concerns. While gamification may be a viable option for short-term assignments, it is essential to acknowledge potential challenges, such as the novelty effect, where its impact may not be sustainable over the long term. This highlights the importance of pedagogical variety, suggesting that educators should avoid relying on a single method indefinitely. Furthermore, more than the mere presence of gamification may be required to address the needs of underachieving students. A more comprehensive approach is needed to support their learning journey (Li & Yu, 2023).

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Kahoot!

Introduction to the Kahoot!

Kahoot! originated from a Lecture Quiz research project at the Norwegian University of Science and Technology in 2006 (Wang et al., 2007) and was officially released in 2013 (Murawski et al., 2019). Over time, Kahoot! It has solidified its standing as a widely recognized and adopted gamified learning instrument within the realm of education (Cristian, 2023). The platform facilitates teacher-learner interaction in varying-sized classrooms through competitive knowledge games, utilizing existing infrastructure and requiring a reliable Internet connection (Lin & Kaur, 2018).

At the core of Kahoot! is its functioning as a Game-Based Student Response System (GSRS) (Wang, 2015). Instructors can design interactive quizzes seamlessly integrated into standard lecture slides. Students engage with these quizzes in a game-show-like format using web browsers on digital devices. Incorporating multimedia elements, including images and videos, enriches the learning experience, with instructors controlling the game's pacing (Licorish et al., 2017). Student performance is rewarded with points for correct answers, and the real-time scoring system, akin to a game show, creates an environment that motivates learners to strive for the top of the leaderboard.

The Impact of Kahoot! in Motivation and Engagement

Kahoot! as an educational tool yielded significant results in motivation and engagement. Through student interviews, Licorish et al. (2018) discovered that Kahoot! could capture students' attention and stimulate their interest in the classroom, especially for lectures and discussions that lasted longer than an hour, providing well-timed breaks. Additionally, Kahoot's anonymous and interactive nature! Enabled students to focus more on each other's perspectives without the pressure of competition rather than comparing their abilities with each other. Wichadee and Pattanapichet (2018) further emphasized the effectiveness of Kahoot! in deepening students' understanding of vocabulary and course concepts in the context of language learning, while Biçen and Kocakoyun (2018) noted that Kahoot! also helped students become more active learners and develop a sense of collaboration. In addition, some studies (Göksün and Gürsoy, 2019; Mulyadi et al., 2019) compared Kahoot! with other platforms. The results indicate that Kahoot! Significant differences in academic achievement, especially in improving academic performance. From an educational theory perspective, these results support the applicability of Kahoot! to higher education as a tool for promoting positive learning behaviors and creating a conducive learning environment.

However, not all studies have been positive about the learning outcomes of Kahoot! Wang and Tahir (2015) identified several challenges, including difficulties for students in reading and answering on-screen questions, time pressures, and difficulties for instructors in designing questions to match the level of students. In addition, Plump and LaRosa (2017) also mentioned that some colleges need more digital literacy opportunities, expertise, or knowledge to utilize digital games in their curricula fully. Similarly, Omar's (2017) study highlighted problems with Kahoot! Regarding feedback quality, including unclear guidelines, limited discussion time, and restrictions on answer reveal. Furthermore, Licorish et al. noted that despite the positive media coverage of Kahoot! The competitive element may increase anxiety for some students. Reynolds and Taylor (2020), in a study of EFL students at a Korean university, found no statistically significant difference between groups using Kahoot! for vocabulary learning and traditional

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groups. Thus, they questioned the positive impact of Kahoot! on students' vocabulary learning achievements. However, they also clarified that this negativity does not mean that Kahoot! Causes learners to underperform. Therefore, teachers can choose whether to use the Kahoot! Depending on the context and students' needs.

Research Gaps and Future Directions

In recent years, gamified learning has become an emerging approach to subvert the traditional teaching model. It has triggered extensive attention from the academic community due to the continuous evolution and innovation of global education concepts. Although there is existing literature on gamified learning, there are still significant research gaps, especially in exploring the effectiveness of the practical application of gamified learning tools such as Kahoot! in different educational settings and their adaptability in non-Western cultural contexts.

It is important to note that differences in culture and educational systems significantly impact the acceptance of gamified learning and its pedagogical effectiveness. Although educational concepts are gradually transforming and renewed in China, gamified learning strategies are not widely used in educational practice. This is mainly due to the deep-rooted influence of traditional educational concepts, the constraints of the current educational system, and the incompatibility with China's unique cultural contexts.

There is a lack of empirical research on applying gamified learning in Chinese education. Therefore, more rigorous academic exploration is needed to assess its applicability and effectiveness in enhancing learning outcomes. Future research should explore the adaptability of game-based learning in different educational environments from the perspective of cross-cultural comparisons. At the same time, it should focus on the close integration of educational theories and practices to support the further development of game-based learning in the global context.

RESEARCH OBJECTIVES AND METHOD

Research Objectives

The scope of this study was 100 students in the Film and television animation post-synthesis technology course (F111) in the Digital Media Technology program at Guangdong Peizheng College in China. The film and video animation course lasts 16 weeks and is compulsory in the digital media technology program. This study measured the applicability of Kahoot! Gamification teaching platform in this course and its impact on student motivation and engagement over 16 weeks. By investigating the relationship between gamification and student outcomes, this study seeks to reveal the potential benefits and drawbacks of using Kahoot as a pedagogical platform and add empirical evidence to gamified learning. The research objectives of this paper are as follows:

1. To assess the influence of gamifying learning with Kahoot! on student motivation levels.
2. To examine the effect of Kahoot! as a gamified learning platform on student engagement in the educational context.

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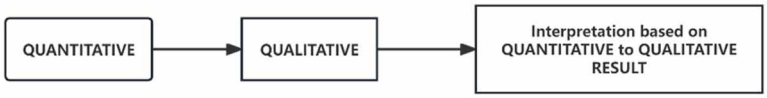
Figure 1. Procedural steps
(Creswell and Plano-Clark, 2006)



Method

The study employed a mixed methods approach, integrating qualitative and quantitative research methods, data collection instruments, and analytical techniques to explore and validate research findings comprehensively (Johnson et al., 2007). As Creswell and Plano Clark (2007) outlined, the research addressed qualitative and quantitative research inquiries. We used a quantitative approach to examine the first and second research questions, collecting data from experimental and control groups to assess students' motivation and engagement throughout the experimental phase. To gain deeper insights into their perspectives and to validate the quantitative data, it was essential to conduct focus group interviews with students who had used Kahoot! The data collection process for both quantitative and qualitative data was conducted independently, and each data type was analyzed separately and then correlated to address the research questions effectively. This approach was undertaken to comprehensively examine the student's viewpoints and provide robust answers to the research questions.

Additionally, the researcher employed an explanatory sequential mixed-method design in this study, following Creswell's (2021) framework. The explanatory sequential design typically commences with a quantitative approach and then integrates qualitative elements, resulting in the explanatory sequential mixed-methods approach. The procedural steps of this design are shown in Figure 1.

Detail of Courses F111

Post-production Synthesis Technology for Film and Video Animation (F111) is a basic course for Digital Media Technology majors, aiming to cultivate students' ability to create special artistic visual effects in film and television, advertising, and multimedia production. The course contains 48 lessons, each lasting 45 minutes, three classes per week, including 20 lessons of theoretical knowledge teaching and 28 lessons of practical software operation teaching. The student's final course grade is assessed by a combination of sections, as shown in Figure 2:

Organization of Kahoot! on the F111

Short Exam

The short test is divided into two parts designed to assess student progress in the classroom. First, the first part reviews the previous week's lesson. At the beginning of the lesson, the instructor uses the Kahoot! Platform to post a series of questions that cover important points from the previous week's lesson. For example, suppose keyframe animation on layers was taught last week. In that case, the questions might cover aspects such as the number of layer attributes, the sign of keyframes, and the difference

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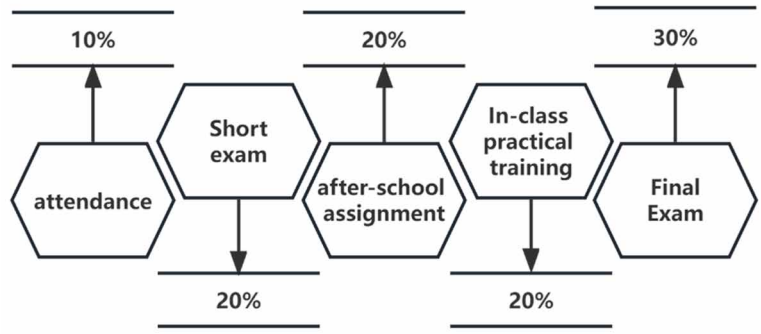
Figure 2. Structure for assessing students' final course grades



between spatially interpolated linear and Bezier curves. This part aims to test the student's mastery of last week's content.

The second part focuses on testing the knowledge of this week's lesson. Again, the instructor uses Kahoot! to post questions for students to answer. In this process, students can answer the questions individually or in teams, and the types of questions include a variety of topics such as single-choice, multiple-choice, sequencing, and sliding-scale questions. After answering each question, Kahoot! Records individual and team scores for timely assessment and feedback. This two-part test helps to assess student performance fully and provides a variety of interactive methods to promote active participation.

After-School Assignment

The Kahoot! platform was used to assign and track after-school assignments to better manage student progress and assignment completion. The after-school assignments were categorized into two different types: practical and process assignments.

First, process assignments designed to complement the final team narrative animation production. Throughout the 16-week course, the production process was broken down into four different stages of assignments to ensure that students progressively completed the animation project. These phases include script writing, design of the split screen, character and scene drawing, and final animation of the main scenes. On the Kahoot! Platform: students can view their progress and the progress of the whole team in the process so that they can make timely adjustments and monitor the completion of the project.

In addition, the practice-based assignments are designed to allow students to apply what they have learned to animation. In addition to the four process-based assignments, these assignments are assigned weekly to test whether students can master the knowledge points in the course and apply them to actual animation creation. Students create their home pages on the Kahoot! Platform and upload their completed assignments to their home pages, which are subsequently shared on the class's public channel for others to view.

Final Exam

After completing the final exam, students must share their team's work on the class channel on Kahoot! This phase is a key highlight of the course as it allows students to showcase what they have accomplished in animation production. During the final week of class, students could utilize the sharing features of

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Kahoot! to present their accomplishments. This presentation session allows students to showcase their work and promotes the development of oral presentation and communication skills.

In addition to the presentations, students can also use Kahoot! Platform to grade each other's work among their peers. This mutual grading mechanism helps students gain a more comprehensive understanding of their work and that of other teams, providing valuable feedback and suggestions. The ability for students to score and provide comments on their classmates' work on Kahoot! It helps promote respect and understanding of different creative styles and approaches.

Finally, based on scores and performance, the top teams will receive awards recognizing their excellence in animation production projects. This reward system will motivate students to work harder on their collaborations and creations and encourage them to participate and share on the Kahoot! Platform. All in all, this program is designed to not only help students grow academically but also develop their teamwork, expression, and creativity.

DATA COLLECTION AND ANALYSIS

Participants

This section will provide a comprehensive overview of the data collection and analysis process, encompassing participant details, methods, procedures, and data analysis. The study comprised 100 students enrolled in the F111 course within the Digital Media Technology program at Guangdong Peizheng College during the 2023-2024 academic year. Using their original class placements, the participants were divided into two groups based on the experimental and control design. Group A (Kahoot! experimental group) consisted of 51 students, while Group B (no Kahoot! control group) included 49 students.

Instruments

This study utilized an interpretive sequential mixed research methodology that synthesized quantitative and qualitative data collection methods and incorporated qualitative elements based on the quantitative data to present the study results. The main purpose of the quantitative data was to assess the impact of Kahoot! on student engagement and motivation, which was analyzed by comparing the differences in data between the experimental and control groups. For this purpose, a survey on engagement and motivation (pre-test) was administered to students in the experimental and control groups at the beginning of the semester. As shown in Table 1. Subsequently, the experimental group received the Kahoot! Intervention and the same survey (post-test) were administered again at the end of the semester to assess the impact of the intervention. Meanwhile, the control group also took the same survey at the end of the semester for comparison.

Table 1. Quantitative experimental design

Control Group	Pre-test	No Kahoot!	Post-test
Experimental Group	Pre-test	Kahoot! Intervention	Post-test

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In addition, semi-structured interviews and focus group discussions were used to collect qualitative data. To ensure multi-perspective data collection, we randomly selected five students in the course for semi-structured interviews to gain insight into their perceptions and experiences. We also invited the last 8% of students in the experimental group to participate in a focus group discussion to gain a broader range of perspectives and viewpoints. This integrated approach contributes to a comprehensive understanding of the impact and effectiveness of Kahoot! in student learning.

Quantitative Instruments

To investigate the impact of student motivation, this study used the ARCS model scale proposed by Keller (2010). It was adapted into a 16-item scale covering four dimensions: self-confidence, attention, satisfaction, and relevance, each containing four questions. As for assessing the impact of student engagement, the Student Engagement Instrument (SEI) developed by Appleton et al. (2006), designed to measure student engagement's cognitive and affective components, was chosen for this study. Specifically, it includes two subtypes of cognitive engagement covering control and relevance of schoolwork, future goals, and aspirations, and three subtypes of affective engagement, including teacher-student relationships, peer support for learning, and family support for learning. To ensure appropriateness, each subtype was adopted in this study so that each subtype contained three items for 15 items. The items used a 5-point Likert scale describing 1 (Strongly disagree), 2 (Disagree), 3 (Neutral), 4 (Agree), and 5 (Strongly Agree). The instruments' items are presented in Table 2.

Qualitative Instrument

This study conducted semi-structured interviews with five respondents who were asked several questions about using Kahoot! and were asked to provide some of their overall experiences with the platform. Questions included "Do you like Kahoot! as a class format? Why?", "Which do you prefer, taking classes with Kahoot! or a general class format? Why?" etc. Focus group discussions were conducted with the bottom 8% of students in the experimental and control groups on their experiences with the course, problems they encountered in actual learning, and their future career plans.

Data Collection

In this study, 100 students participated, all of whom had yet to gain experience with Kahoot! Gamified learning intervention. To assess the impact of Kahoot! on the engagement and motivation of these students, we conducted a pre-test and a post-test. During the pre-test phase, we received 100 questionnaires to get the students' baseline. Subsequently, after the Kahoot! We conducted a posttest as an intervention and 96 valid questionnaires were returned. Specifically, the number of post-test questionnaires for the experimental group, Group A, was 50, while the control group, Group B, was 46. The collection and analysis of these questionnaire data helped us to assess the impact and effectiveness of Kahoot! in student learning.

Data Analysis

A standardized protocol was used to calculate scores for each adapted ARCS and SEI scale item to ensure the reliability and validity of these questions as a research instrument. As shown in Table 3, Cronbach's

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Table 2. Student evaluations of the F111 course

Motivation
Confidence MC1. When I first looked at this lesson, I thought it would be easy. MC2. Whenever the teacher introduces the day's task at the beginning of the lesson, I can always be sure that I know what I am supposed to learn for the rest of the lesson! MC3. As I worked on this lesson, I was confident I could learn the content. MC4. After working on this lesson for a while, I was confident that I would be able to pass a test on it
Attention MA1. The teaching approach used (Kahoot!) was eye-catching. MA2. The content of this class can keep my attention focused at all times. MA3. I learned some things that were surprising or unexpected. MA4. I find this class very interesting.
Satisfaction MS1. Completing the exercises in the course gave me a satisfying sense of accomplishment. MS2. I enjoyed studying this lesson. MS3. It felt good to complete this lesson successfully. MS4. Getting good results or comments from teachers after practicing makes me feel like my efforts are paying off.
Relevance MR1. This course will help me in my future career. MR2. The content on teaching methods was very helpful to me. MR3. The knowledge in the course reminds me of examples in my life. MR4. The learning is relevant to what I am interested in.
Engagement
Control and Relevance of Schoolwork EC1. If the process of doing the homework creates problems, I will check the project until I find the cause. EC2. I demonstrated my interest and enthusiasm and was positive during the course. EC3. Learning this course was joyful because I had some knowledge I learned very well.
Future Goals and Aspirations EF1. This class will create many opportunities for my future career. EF2. I plan to pass this class very well. EF3. I am confident about my future.
Teacher-Student Relationships ET1. My teacher has been very helpful in this class. EF2. The atmosphere of my teacher's class makes me feel relaxed. EF3. In class, I can express my ideas freely.
Peer Support for Learning EP1. In the classroom, I enjoyed participating in discussions between teams. EP2. Our teachers provide us with many opportunities to work as a team. EP3. I would love to win for my team.
Family Support for Learning ES1. I am happy to share what I am learning with my family. ES2. My family helps me whenever I have trouble in school. ES3. Whenever I am challenged academically, my family expects me to persevere.

alpha scores were within acceptable tolerances for all items. Next, we performed descriptive statistics on the student's responses and determined the differences in the data between the experimental and control groups by comparing percentages to analyze further whether Kahoot! Increased student motivation and engagement. This methodology was employed to help ensure that our findings were statistically credible and valid.

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Table 3. Cronbach's alpha scores for items on the ARCS and SEI

Psychometric variable	Cronbach's alpha
Confidence	0.860
Attention	0.895
Satisfaction	0.905
Relevance	0.877
Control and Relevance of Schoolwork	0.898
Future Goals and Aspirations	0.790
Teacher-Student Relationships	0.878
Peer Support for Learning	0.788
Family Support for Learning	0.762

RESULT

Quantitative Data

This study analyzed descriptive statistics using SPSS version 27 for pre-test and post-test, normality, homogeneity, and independent t-tests.

Motivation Data

The first research objective of this study *is "To assess the influence of gamifying learning with Kahoot! on student motivation levels"*. The quantitative data from the study are shown in Table 4-6 and Figure 3.

Table 4 above displays the score distribution for the two student groups. The lowest scores observed were 42 and 43 for the respective groups, while the highest scores were identical at 77. The mean scores for the groups were 60.12 and 58.88, with standard deviations of 10.903 and 10.142, respectively. These statistics suggest that both groups of students were well-matched for the treatment.

As seen in Table 5 above, the minimum scores achieved by both groups were 49 and 39, while the maximum scores for both groups were 80. The mean scores were 69.49 and 62.31, with standard deviations of 7.778 and 9.472, respectively. These findings indicate that the pedagogical approach using Kahoot! Gamified learning platforms had a positive impact on student motivation when compared to traditional teaching methods.

According to the Kolmogorov-Smirnov normality test results, as shown in Table 6, the significance values of both Kahoot! Gamified learning and traditional classrooms were higher than 0.05, with 0.103

Table 4. The results of the descriptive statistic of the pre-test (motivation)

Groups	N	Minimum	Maximum	Mean	SD
Experimental group	51	42	77	60.12	10.903
Control group	49	43	77	58.88	10.142

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Table 5. The results of the descriptive statistic of the post-test (motivation)

Groups	N	Minimum	Maximum	Mean	SD
Experimental group	51	50	80	68.31	8.071
Control group	49	39	80	62.31	9.472

Table 6. The result of normality of the post-test (motivation)

	Normality	
	Kolmogorov-Smirnov	Shapiro
Experimental group	.200	.103
Control group	.200	.784

for the experimental group and 0.784 for the control group. This indicates that the collected data were normally distributed.

According to the information provided in Table 7, including (A) Levene's test for chi-square and (B) t-test results for equality of means. The study showed that the Levene test showed variance chi-square, i.e., "Equal variances assumed," with a value of (F=0.276, p=0.600). The t-test results showed a significant difference with a t-value of 3.342, p<0.001, which indicates that the Kahoot! A gamified classroom has a significant effect on increasing students' motivation compared to the traditional classroom.

Engagement Data

The first research objective of this study *is "To examine the effect of Kahoot! as a gamified learning platform on student engagement in the educational context."*. The quantitative data from the study are shown in Table 7-9 and Figure 4.

Table 7 above shows the pre-test engagement data of the students in the experimental and control groups. The minimum score for both groups was 45, and the maximum scores were 79 and 82, respectively. The mean scores for both groups were 59.88 and 60.94, with standard deviations of 7.667 and 7.355, respectively. These statistics indicate that both groups were suitable for the treatment.

Table 8 shows that the minimum scores for the two student groups were 52 and 45, while the maximum scores were 85 and 82, respectively. The average scores were 70.04 and 60.67, with standard deviations

Figure 3. The result of the independent sample test (motivation)

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Motivation	Equal variances assumed	.276	.600	3.342	98	.001	5.988	1.792	2.432	9.544
	Equal variances not assumed			3.334	95.681	.001	5.988	1.796	2.423	9.553

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Table 7. The results of the descriptive statistic of the pre-test (engagement)

Groups	N	Minimum	Maximum	Mean	SD
Experimental group	51	45	79	59.88	7.667
Control group	49	45	82	60.94	7.355

Table 8. The results of the descriptive statistic of the post-test (engagement)

Groups	N	Minimum	Maximum	Mean	SD
Experimental group	51	52	85	70.04	8.321
Control group	49	45	82	60.67	7.936

of 8.321 and 7.936, respectively. These results indicate that the use of Kahoot! The Gamified learning platform has enhanced student engagement.

Based on the Kolmogorov-Smirnov normality test results, as presented in Table 9, it is noteworthy that the significance values for both Kahoot! Gamified learning and traditional classrooms exceeded 0.05, measuring 0.566 for the experimental group and 0.107 for the control group. This suggests that the gathered data exhibited a normal distribution.

The t-test results yielded a statistically significant difference, as indicated by a t-value of 1.515 and a p-value of less than 0.001. This finding underscores the significant impact of the Kahoot! A gamified classroom enhances student engagement when compared to the traditional classroom.

Qualitative Data

To validate our quantitative analysis findings, semi-structured interviews were conducted with five students from the experimental group. The aim was to gather their perspectives on Kahoot! and solicit any suggestions they might have. Students were asked questions such as:

- How do you perceive the most significant differences between using Kahoot! A gamified platform for classes compared to traditional classroom methods?
- Do you enjoy this course with Kahoot! as a learning platform?
- Do you believe Kahoot! has increased or decreased your level of participation in the course?
- Have you encountered any challenges or difficulties while using Kahoot!
- Does Kahoot! Are you more motivated to explore the class further?

Table 9. The result of normality of the post-test (engagement)

	Normality	
	Kolmogorov-Smirnov	Shapiro
Experimental group	.200	.566
Control group	.200	.107

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Figure 4. The result of the independent sample test (engagement)

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
动机数据	Equal variances assumed	1.515	.221	5.338	98	<.001	9.014	1.689	5.663	12.366
	Equal variances not assumed			5.344	97.964	<.001	9.014	1.687	5.667	12.362

Five students consistently reported that the Kahoot! The gaming platform injected more fun into the course, with four demonstrating high satisfaction. One student emphasized, "Kahoot! Provides more interactive opportunities than traditional classes. In the past, the teacher often taught courses with limited student participation. However, now, we can participate in the quiz break with our classmates, which makes me feel very excited." Three other students echoed this sentiment. Two students said they could not wait for this course each week because it playfully taught them new things.

However, one student also showed decreased motivation in the quantitative data. This student mentioned that due to leaderboards and team competition, he was more worried about his grades and how his performance might affect the team. This caused him to feel anxious. In addition, the short time for each answer made him feel unresponsive. Another student also mentioned that Kahoot! Sometimes, he slowed down the course because too much time was spent on interaction, thus reducing his actual learning time. Two other students echoed this observation, who preferred to follow the instructor in the second half of the course to learn how to operate the software rather than continue playing the game. This feedback provides insight into the complexity of students' perceptions of using Kahoot! in the classroom and highlights its positive and negative impacts.

CONCLUSION

This study has demonstrated that using Kahoot! significantly enhances student motivation and engagement in educational settings, particularly in non-Western educational systems. The findings reveal that while gamified learning platforms like Kahoot! can invigorate the learning environment and contribute to heightened interest and participation, attention must be given to the potential for increased anxiety among some students. Careful integration into the curriculum is necessary to avoid disrupting the instructional flow.

For educators, these results emphasize the importance of adopting a balanced approach to gamification. This approach can harness its benefits to foster an interactive and engaging learning experience while mitigating its drawbacks. Future research should extend beyond the immediate effects of gamified learning by exploring its impact on long-term academic achievement, knowledge retention, and applicability across diverse cultural contexts and educational settings.

This study provides valuable perspectives to the ongoing dialogue on educational innovation by providing a nuanced understanding of gamified learning's potential and challenges. It highlights the need for educators to critically assess and thoughtfully integrate technology-enhanced learning strategies to meet the evolving demands of the 21st-century classroom.

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Work in progress

Engaging professional competencies through gamification

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***Abstract*— This article showcases a gamification implementation design to examine the contribution to professional competencies development of college students who are close to complete internships. This paper analyses through an exploratory approach, the preliminary results of the implementation of a leaderboard that used avatars or nicknames (students' election between both options) when students earn a badge at the same time they prepared for their full-time internship readiness process.**

Keywords— gamification, professional competencies educational innovation, higher education, leaderboard, internship preparation.

I. Introduction

Universities have made particular efforts to prepare their students for the work world they will face once they graduate [1], [2], [3]. As a part of these efforts, Professional Experience and full-time internship programs arise in which students live a full work immersion experience before finishing their bachelor's degree. Internship result from the synergy between academics, employers, and different roles in whose responsibility lies the preparation of professionals for the future, their different scenarios and human needs [4].

This work is the second phase of a gamification design in a preparation course for professional practices based on the development of professional competencies. This course aimed at undergraduate students who will complete a full-time internship. The purpose of the course is to provide tools to know how to choose the best internship. Due to the nature of the course content, we have sought a methodology that allows students to remain interested in course assignments. We have chosen gamification as a viable option for this course due to the benefits it offers, both in terms of motivation and in terms of engagement during the academic semester.

This course is part of the Profesional Experience Modality (MEP) in which students enroll to complete the program integrated by four courses and their full internship experience. Students, most of the time, are hired when graduated by the companies in which they did their internships. Here is the MEP importance of well-prepared students to find a good opportunity for their development as future professionals. As it is known, better-prepared candidates compensate their lack of job experience when they have knowledge of the hiring process [5], but if students are not able to do a good search or try to complete the employers screening methods without conscious preparation, they will not get an internship in a company they were willing to work after graduating.

The development of activities or products related to this preparation such as the arrangement of their resume, interview practice, identification and search of job opportunities platforms, notions of recruitment and hiring processes, as well as an adequate level of their LinkedIn profile, among others, can become tedious, confusing, frustrating and not always appreciated by students. It is important to improve this kind of programs and courses in order to make them attractive and motivating to students, so it may be imperative to include teaching strategies that contribute to it, such as gamification.

Furthermore, in this case, the course is an opportunity to apply gamification in the benefit of professional competencies development related to recruitment processes. In this phase, gamification is not used to demonstrate professional competencies but is been applied to contribute to their development considering the need of well-prepared students in job topics and the challenge this preparation represents to universities.

A. *Gamification in higher education*

Gamification has become one of the most innovative pedagogical trends due to the benefits it offers. Gamification makes participants in a course more involved with their learning as well as their level of progress. In education, the application of concepts and elements of the game as part of the design of the learning process is discussed [6].

Recent studies have shown that gamification in higher education is having good results [7, 8, 9, 10] because it can place the student in scenarios that involve the realization of challenges, in such a way that increases their level of commitment and competitiveness [11, 12], which favors intrinsic motivation [13, 14]. Likewise, gamification allows the generation of reward systems that help promote extrinsic motivation [15, 16].

Moreover, gamification allows the emotional, social and cognitive aspects to converge into the same gamified educational experience [17, 18]. The cognitive aspect occurs when the student obtains immediate feedback and is given several attempts (chances) in such a way that he is taken to a metacognitive process or when faced with a challenge [10].

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The emotional aspect is when the students obtain recognition for their achievement (badge, rewards, and points) [19] while the social aspect happens when the achievements are socialized through a leadership board or when students work collaboratively to achieve a challenge or mission [20].

There are several models of Gamification [21, 22, 23] which start from the same idea: "take elements of the game in non-game contexts" [24]. For this study, we took the Werbach and Hunter model [25]; this model structures the Gamification into three elements: dynamic, mechanical and components, which can be combined according to the objectives to be achieved.

Dynamics are the contexts in which Gamification develops (e.g. emotional, narrative, social, progressions), the mechanics are the activities within the dynamics (e.g. challenges, opportunities, rewards) and the components (e.g. badges, points, classification boards) are objects, digital or not, used within mechanics [26]. Including Gamification for the design of an environment or learning activities also favors the creative process of the teacher [11].

B. *Professional Competencies*

The development of professional competencies is relevant in university education. Professional competencies reflect the ability to solve a specific activity in a complex scenario, such as the working world [27].

The future of Jobs Report [28] refers to the importance of preparing professionals in transversal competencies [29] that allow graduates to achieve optimum performance for the real world they face when they finish their university studies. Professional competencies, unlike disciplinary ones, refer to a set of attributes of individuals of professional training, which are precisely the competencies that employers look for in a candidate beyond technical or disciplinary aspects [30]. Since their performance will be measured according to that set of attributes [31] that allow the best performance in accordance with what is expected and required of a competent professional, both in individuals being and that referred to their profession [32].

These professional competencies are those that allow universities to ensure an insertion into the work world of their graduates [1]. And the students themselves, to be prepared to develop in the work world since they can demonstrate that they are capable of not only applying knowledge of their professional area but face the different real-world scenarios according to adequate performance [32] or what in terms of competencies refers to a complex and authentic context [31].

Professional competencies are developed from different academic efforts, particularly, which involve action or an active role of students. For example, project-based learning, problem-based learning, case studies, problem-solving, collaborative work, among others [2]. In this sense, immersion in the world of work during a professional practice contributes to the development of professional skills and experiences from the practice in a work environment, which would not be achieved in the classroom.

II. METHOD

A. *Methodological Approach*

In this research, we use the qualitative method with the exploratory approach using a non-probabilistic sample. The data collection was first carried out through the Blackboard platform when students chose their avatar or nickname and explained the reason for their selection.

Once we had this information, we searched for common categories for the choice of avatar or nickname. The observation of reactions and inputs was made during the course sessions and inputs were received from the students. On the other hand, online questionnaires were applied once the course started and the students selected their avatar or nickname and the first badge was awarded.

After collecting the information, it was placed in an Excel matrix in such a way that it allows comparing the data of each source of information and thus, analyzing the coincidences and dissidents.

At the end of the course, students had to answer an online survey with the course and gamification feedback purposes. There was a section related to gamification and the reward system to inquire about students' satisfaction and their opinion through seven questions in a Liker scale. Items for gamification in the survey were:

The reward system (badges) of the course:

a) Motivates you to participate in class and/or to do the course activities.

b) Must remain anonymous until the end of the course.

c) In your opinion, is related to the course content.

d) The badge assignation policies in the course are appropriated.

e) You are satisfied with the badges awarded during the course.

f) The leadership board let you know which badges you won.

g) The time for the announcement of each badge awarded was adequate.

Students were invited during this online questionnaire to agree or disagree in showing their results and motivations including their avatars or nickname with research purposes maintaining their anonymous identity.

B. *Course Description*

The Growth-Related Competencies course prepares students in aspects related to their internship search. In it, topics that include but are not limited to curriculum vitae, mock interview practice, internship search on various platforms, LinkedIn profile, among other topics, are working on. Gamification presented in this research was designed in this context to help students to engage with their learning process among sixteen sessions while they are prepared for an internship opportunity search that best fit with their current professional competencies and the vacancies from different companies of their interest.

C. *Population*

The sample is composed of 19 students studying in a private high school and looking for an internship, of which 42% are in the third to the seventh semester at engineering

school. The ages of the students vary in a range of 20 to 24 years old. Most of them had taken two courses before this course to prepare in personal and in goal-oriented competencies according to the MEP program.

D. Learning experience

The course was gamified through a badge rewards system. The badges established for this course were Victory, Resilience, Effective communication, Networking, Perseverance, Audacity, and Revelation due to the course aim. Each badge had an established criterion under which students could obtain the badges during the academic period. Most of the time, badges were assigned to an outstanding performance during the course assignments, but specifically for effective communication and resilience, students had to do extra tasks related to the activity in which they got badges.

For example, to obtain effective communication badge, when students had the mock interview practice, they had to record an audio with the feedback in order to show the comments they received from the advisor – interviewer and the comprehension of comments. This audio had to show the performance during the practice and the way they communicated. In addition, to obtain a resilience badge in this same activity, students had to show a reflection of the impression of the mock interview practice and feedback session.

Another component of the reward system was the use of avatars or nicknames in line with students' preferences. To integrate the leaderboard of the class, students had to choose either of the two options and justify the reason for their election of avatar or nickname that would be shown on the Blackboard platform where the course is hosted. We presented the leaderboard in class to announce the advance of each "character" according to the badges awarded in the different activities of the course.

Because it is an optional activity, students who have decided not to participate were not affected in their evaluation; however, they had the opportunity to join the leaderboard at any time during the course. Once they joined the gamification, students participated to win the available badges from this moment to the end of the course.

III. Results and Discussion

A. Choice of avatar or nickname

The first activity of the course was to choose an avatar or a nickname, according to students' preferences to integrate the leaderboard with the announcement that this choice would be their identity on the leaderboard, while their names would remain secret until the end of the course.

Six students choose an avatar and eleven choose a nickname. In accordance with the question about to justify their selection of nicknames or avatars, it was possible to categorize the reasons finding that 53% of the students chose a character with whom they identify in specific characteristics, from personality to attitudes or habits. In some cases, these characters represented a dream of who or how they want to be. In the same sense, the 12% identified themselves with animals because they are their favorite and considered they have similarities in their abilities, while 6% chose their nickname or avatar as a reminder of their pride in their current achievements.

The other 24% made their choice according to nicknames or remembrances of their childhood or some particular or curious fact about them. A case was also presented in which the student chose her nickname according to her personal motto ("*LaDeLaSonrisa*" – The one with the smile - because she always smiles and nods when she is in a situation where she does not know how to respond). Two students gave their avatar without explaining the relationship or the reason for choosing it. Beyond this, the explanation that the rest of the group gave about their choice of avatar or nickname showed that it was really due to a personal reason for them and for that reason, their election had a special meaning.

This reflection of personal skills and abilities that relate students to their gamified identity, offers a positive atmosphere and predisposition to a better rhythm of the class. Not only students already started with positive emotion, they can earn something (badge) but also they related their self-image to particular characteristics with which they identified in a positive way.

On the other hand, maintaining anonymous real identity contributed to the students not feeling exposed to their classmates, especially when they did not earn a badge in each activity. Although when some students won a badge, they wanted the whole group to know they were the winners. Another positive aspect is that they not only respected anonymity, but it was more rewarding for students who earned badges in the outdoors challenge-related activity that their peers began to associate the identities of the leaderboard with the real identities of each of the winners.

B. Getting Badges

We defined the meaning of badges in the course context and the criteria to achieve each of them. In this way, students knew each badge's rules before the activities and if the teacher would award them or it would be voted by the group.

Even though criteria to win the badge were available at the same time as the activities instructions, teachers reminded and explained what students had to do in order to obtain the specific badge linked to the assignment.

The first badge we granted was Victory; students had to answer an online quiz with six questions connected to the resume rules. Points were assigned by the site we used and the badge was granted to the two students who got the highest points in one and in two attempts. At this moment, students were satisfied with the assignation of the badge because they appreciated the opportunity to gain the Victory badge either if they pass the exam in one attempt or in two, so they had the same chance to win the badge.

The second badge turned into a learning experience for students because they felt disappointed and reflective when they found no one got the Effective Communication badge associated to write an email to send their resume to employers. None of the students had an outstanding performance or showed appropriate writing skills. More than this, students did not complete the requirements for the assignment. This situation helped to reinforce in students the need to pay close attention to instructions and to find that they can gain badges but not as automatically assignation just for doing their homework. Moreover, students learned that

obtaining a badge was not necessarily related to the assignment grade or vice versa [33].

An important characteristic of gamification is that the challenges should be attainable for students to maintain motivation in achieving the course goals related to gamification but representing a challenge and difficulty [6]. Students found this situation with the Effective Communication badge. Once they recovered from the initial disappointment, they understood it was important to give a little extra on their assignments not only to get the maximum grade in the assignment but also to win the badge.

The grant of the other badges did not represent a hard time for students to understand what they needed to do to earn the badge or how the winners were determined.

In the case of the outdoor challenge-related activity, students voted for their classmates to recognize their performance during the different challenges they had as a group. According to the given reason to defend their vote, they were really rewarding their peers. This tells us students were engaged with the badges they granted and the awards.

The last opportunity to earn Effective Communication and Resilience badges was during the mock interview practice but group participation decreased. As indicated earlier, students had to record audio and write or record a reflection of the experience and feedback they received. On one hand, this instruction was given during the second part of the course and the delivery of this assignment had the deadline at the end of the course to give students the chance to go to their Life and Career Center for this service. We consider that the time between the instructions and the deadline caused students to forget this part of the activity. On the other hand, most of the students had this practice in the last month of the semester, when they had final exams or projects of other subjects causing low interest in giving extra effort or time to the extra assignment.

Perseverance badge was given at the end of the semester to recognize the four students who attended the sixteen classes and delivered their assignments at the proper time. Table 1 shows the distribution of each badge at the end of the semester.

TABLE I. TOTAL OF AWARDED BADGES

Badge	**Awarded badges**	
	Number of badges earned per group	***Number of students who earned the same badge more than once***
Victory	2	0
Effective Communication	6	0
Networking	5	2
Resilience	6	1
Audacity	1	0
Revelation	1	0
Perseverance	4	0

From the online survey, we found that the majority of the students were satisfied according to the answers given in the range of “agree and totally agree” (84.61%) to the questions related to gamification and its appropriateness. While 7.69% was undecided (not agree or disagree) and the same percentage totally disagreed. Likewise, they expressed that badges are valuable for them because the award means the recognition of their teacher and their peers for their performance in different activities. In this sense, students not only have a grade-related satisfaction, they got personal recognition for their effort.

As noticed, there was a student who expressed he totally disagrees with the badge system and the way we conducted it. It is important to mention this student did not get any of the badges despite he got a satisfactory final grade, but he did not show an excellent or outstanding performance during gamification activities. Therefore, as mentioned before, the system reward of this course had no negative impact in the final grade of the students who decided not to participate or got any badge.

According to the model of Werbach and Hunter [24] in the course, we have the three elements of gamification, we have the narrative (dynamic) in which students can earn badges (component). The emotional attribute is also present since the beginning when students identified themselves with their nicknames or avatars or even when they realized they got a badge for their extra effort or outstanding performance during an activity.

This gamification design also has the component in which students can record their advance in the course, get feedback and achieve attainable course challenges. This aspect also increases students’ motivation [34].

Despite the fact that we presented the leaderboard as the main element of this gamification, it is clear that the leaderboard was the excuse to motivate students to participate to gain badges and get feedback. It is unusual to find leaderboards as the only gamification element [35] due to it is part of the social benefit.

We also noticed that in spite of gamification associated to grades and the discussion in which educators perceived that students prefer extra points mostly [36], in this case, students used awarded badges to reinforce their self-image and motivation to improve in their employable-products such as resume, LinkedIn profile, among others. Won badges translated to extra final points but the mean of final gamified-grades compared to final grades was different only for four points. In fact, this difference means students have a certain domain of professional competencies related to job or internship search beyond their final grade.

IV. CONCLUSIONS

Gamification offers benefits that must be exploited in different scenarios such as job seek readiness. However, to avoid the risk of it simply becoming "a fun class" it is important to have a proper design. In order to achieve the satisfaction of both, the students and the teaching team, it is necessary to rescue the benefits of gamification, beyond the playful tone and a competition (contest) among the members.

It is a success and an advantage to be able to gamify content and encourage students’ participation who, at the same time, develop their professional competencies and perform specific activities to prepare for the search for their internships. The integrated gamification of a course allows more involvement of students and teachers when it is not seen as an additional burden and when the rewards are possible to earn.

The leaderboard encouraged students to improve their performance as a personal achievement. Results obtained so far, encourage us to continue with the gamification since a remarkable improvement in the students' performance and attitude was achieved.

Students appreciated the leaderboard as a reaffirming, from teacher and classmates, of their effort and task performance. This allows them to engage with the course and the reward system because they saw a personal benefit beyond the extra points they earned.

The next steps will be defined to improve the gamification design according to Werbach and Hunter model and the transference to other courses. A way to continue is to reinforce the narrative and components, as well as an improved socializing method and stress communication of gamified results.

In addition, the next steps can also aim to figure out an evaluation of competencies level through gamification and its impact on professional competencies development as a contribution to job professional insertion readiness.

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