



Gamification and collaborative learning in higher education students

Gamificación y aprendizaje colaborativo en estudiantes de educación superior

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Abstract

This study was conducted to determine whether gamification strategies influence student collaboration in a higher education course and to establish how these strategies affect students' collaborative learning. To achieve this, a blended learning course was designed for an official Mexican program using gamification strategies. A total of 128 students participated, divided into four large groups. They were administered the COLLES survey at the beginning and end of the course. Key informants were also interviewed to gain deeper insight into their perceptions of the course and the collaborative learning achieved. The results revealed that scores across all dimensions of the COLLES increased from the pretest to the post-test. Meanwhile, the interviews identified seven themes that align with the analyzed dimensions. To achieve these results, three key elements were identified: first, ensuring that the course design is appropriate; second, ensuring student commitment to teamwork; and third, the instructor's support for students to enable collaborative learning. Among the findings is that gamification strategies do have an impact on group work, particularly in terms of relevance and reflective thinking; furthermore, the three key elements mentioned above were essential for fostering collaborative learning.

Keywords: collaborative learning, gamification, instructional design, higher education, students, methodology.

Resumen

El presente estudio se realizó con los objetivos de comprobar si las estrategias de gamificación inciden en el trabajo colaborativo del estudiantado en un curso de educación superior y establecer de qué forma estas estrategias inciden en el aprendizaje colaborativo del estudiantado. Para lograr lo anterior, se diseñó un curso en modalidad blended learning de un programa oficial mexicano empleando estrategias de gamificación. Participaron 128 estudiantes divididos en cuatro grandes grupos. Se administró la encuesta COLLES al inicio y al final del curso. También se entrevistó a informantes clave para profundizar sobre sus percepciones sobre el curso y el aprendizaje colaborativo alcanzado. Los resultados revelaron que los puntajes de todas las dimensiones del COLLES aumentaron del pretest al postest. Por su parte, en las entrevistas se encontraron siete temas que coinciden con las dimensiones analizadas. Para lograr estos resultados se identificaron tres elementos clave: primero, verificar que el diseño del curso que es el adecuado, segundo que haya compromiso por parte del estudiantado para el trabajo en equipo y tercero, el apoyo del profesor hacia sus estudiantes que les permita lograr el aprendizaje colaborativo. Entre las conclusiones se encuentra que las estrategias de gamificación sí tienen incidencia en el trabajo grupal, principalmente en las dimensiones de relevancia y pensamiento reflexivo, además, que los tres elementos clave anteriormente mencionados fueron vitales para lograr el aprendizaje colaborativo.

Palabras clave: aprendizaje colaborativo, gamificación, diseño instruccional, educación superior, estudiantes, metodología.

1. Introduction

There is no doubt that technological advances have enabled the development of new ways of working; however, within the field of education, these advancements demand new dynamics, methodologies, and strategies that optimize and improve teaching and learning processes. Such approaches must center on the student as the key actor in their own education, driving a dynamic, personalized, and self-regulated process to develop core competencies such as critical thinking, problem-solving, creativity, and collaboration. To increase the effectiveness of these methodologies and ensure their long-term impact on students' personal and professional growth, they must be highly engaging (Aparicio-Gómez et al., 2024), yield high value for their development (Martínez et al., 2023), and remain meaningful over time (Shilling et al., 2023).

One of the active methodologies that effectively meets these requirements is gamification (Dewi et al., 2023; Malvasi and Recio-Moreno, 2022; Mendes et al., 2022). Its widespread popularity is based primarily on the integration of game and video game design elements into non-game contexts (Deterding et al., 2011). Although there is conceptual confusion among novice teachers and students who mistakenly equate gamification with simply playing a video game (Prieto-Andreu, 2024), it involves deploying the specific mechanics and dynamics that make games appealing. This allows educators to develop structured, dynamic activities that motivate students to solve academic tasks in innovative and collaborative ways (Li et al., 2026), thereby sparking students' interest in overcoming challenges to achieve higher levels of competence, while concurrently fostering academic commitment and success (Elsawah, 2025).

Another widely recognized methodology is collaborative learning, as it demands the sustained participation of students through a combination of shared effort and teamwork, with the goal of working together for the collective benefit of the group (Dewi and Wahyu, 2026). Its success hinges upon establishing clear, well-defined communication channels to achieve common goals (Du et al., 2025). Empirical studies on collaborative learning have robustly demonstrated its effectiveness across various educational levels (Suaco et al., 2023) and

instructional settings (Wang et al., 2024), yielding positive outcomes particularly within higher education (Karkoulin, 2025). In this context, it fosters meaningful learning experiences while strengthening the interpersonal and professional skills that are vital for students' future career development (Gómez et al., 2025).

1.1 Gamification and Collaborative Learning

The relevance of both gamification and collaborative learning within the teaching and learning process lies primarily in their capacity to enhance motivation, active participation, cooperation, and interaction among students, teachers, and between these two groups (Durán Chinchilla and Rosado Gómez, 2023). This outcome is driven by the fact that gamification inherently incorporates social elements that foster deep human interaction (Restrepo-Tamayo et al., 2025). Furthermore, empirical evidence underscores that both methodologies substantially improve students' academic performance (Alcívar Rivadeneira and Chancay Cedeño, 2023), contribute to the construction of meaningful new knowledge through self-directed learning pathways (Tupthong and Chatwattana, 2025), and enhance their complex problem-solving skills (Lee et al., 2023).

Other studies have demonstrated that gamification, when compared to alternative game-based methodologies, promotes collaborative learning with highly positive outcomes. For example, Qiao et al. (2024) and Amirthalingam et al. (2023) compared gamification mechanics with strategies from other pedagogical methodologies, identifying significant differences, most notably that gamification more effectively catalyzed collaboration and interpersonal communication. Regarding motivation within student work teams, inquiries such as those by Grabner-Hagen and Kingsley (2023) and Firdaus et al. (2023) consistently agree that gamification generates sufficient intrinsic motivation for students to sustain active collaboration with their peers. Other critical determinants for the success of gamification within collaborative learning frameworks depend on effective instructional design (Pérez-Aranda et al., 2024), structured internal team management and group accountability (Maraza et al., 2024), and the emotional well-being of the students (Tsang et al., 2024).

1.2 Problem Statement

While significant progress and successful outcomes have been documented regarding these methodologies—both of which are crucial in contemporary education—several challenges remain particularly relevant within higher education. These obstacles stem primarily from faculty members' lack of familiarity with how to systematically apply these methodologies to their instructional practice, as observed with gamification (Tafur-Méndez et al., 2023), or from a lack of designated time to execute collaborative activities, especially within virtual or online environments, as seen in collaborative learning frameworks (Burchart and Haake, 2024; Dijkstra et al., 2025).

Consequently, it is essential that both faculty members and higher education institutions actively develop these methodological approaches. From the students' perspective, traditional teaching methods fail to foster motivation to learn (Kumar, 2026), and a merely instrumental use of digital technology proves ineffective (Idoiaga et al., 2024); therefore, pedagogical strategies and methodologies tailored to the needs of current and future generations of students are urgently required.

This compelling need has motivated the development of this research which investigates the integration of both methodologies among higher education students within a virtual or hybrid environment. Specifically, this research examines a comprehensive instructional design for a university course that strategically incorporates gamification elements to actively foster and sustain collaborative learning.

1.3 Research Question and Objectives

Based on the premises, the following research question arose: How do gamification strategies

influence collaborative learning among higher education students? To address this question, two primary research objectives were established:

O1. To determine whether gamification strategies influence students' collaborative work within a higher education course.

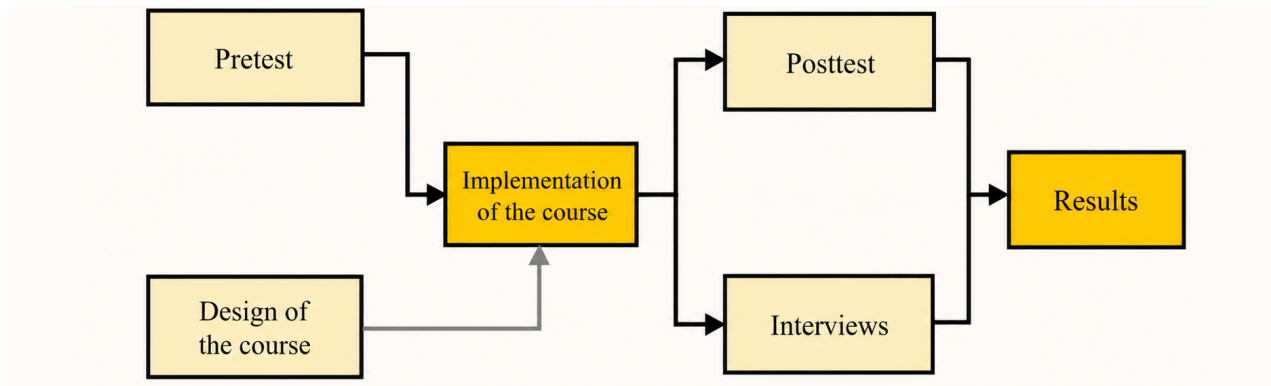
O2. To determine how gamification strategies influence students' collaborative learning within a higher education course.

2 Methodology

Based on the stated objectives, the study focused on examining the impact of gamification strategies on collaborative learning. Therefore, a mixed-methods design was selected to integrate both quantitative and qualitative techniques, strategies, and approaches to achieve a deep and robust understanding of the research problem. Specifically, a quasi-experimental study supported by a complementary qualitative analysis was chosen (Forni and Grande, 2020).

The intervention consisted of implementing a course that incorporated gamification strategies for university students. Upon enrollment and subsequent completion, these participants filled out a collaborative learning self-assessment survey administered before the course began (pre-test) and at its conclusion (post-test). Additionally, semi-structured interviews were conducted with the participants who demonstrated the highest levels of engagement during the process. These interviews complemented the quantitative survey results, providing deep qualitative insights into the phenomenon.

Figure 1 presents the structural framework followed for this research, illustrating the chronological steps of the process and the precise relationship between the methodologies deployed.

Figure 1. *Research Framework*

Note: Prepared by the authors.

2.1 Course Design

The course selected for this study was “Documentary Research,” which is embedded within an official higher education curriculum. It comprises a total duration of 104 hours, strategically divided between face-to-face sessions and distance learning—a configuration that Adukaite et al. (2017) classify as blended learning or b-learning. The course structure was organized into three core units, culminating in the mandatory submission of a group-based research project at the end of the term.

To develop the instructional design, a gamified Interactive Learning Event (ILE) (Kapp, 2012) was deployed, seamlessly integrating interactive dynamics, mechanics, and components (Werbach and Hunter, 2020). The ILE was engineered primarily to foster sustained participation and peer collaboration among students throughout the academic period. The overarching course strategy was operationalized through the PBL triad, which denotes the systematic use of Points, Badges, and Leaderboards. Werbach and Hunter (2020) consider these mechanics essential for effective gamification implementation; additionally, other contemporary mechanics, such as narrative arcs and structured rewards, were integrated into the design (Lang and Song, 2025).

The course’s narrative theme and contextual framework utilized elements of medieval fantasy to construct a more immersive and engaging educational environment. Consequently, several conventional academic terms and course components were modified and replaced with expressions aligned with this

thematic universe (Kapp, 2012); for instance, traditional “Assignments” were rebranded as “Missions,” “Assessments” were replaced by “Levels,” and standard “Grade Points” were converted into “Diamonds.” Meticulous attention was also dedicated to the design of instructional materials and the online learning management system, adopting a medieval aesthetic that complemented the visual, auditory, and contextual parameters established for the course.

The Missions were designed around a problem-solving approach that strictly required collaborative resolution. Furthermore, the completion of successive levels had to be demonstrated through concrete evidence of teamwork, documented either via a collective learning portfolio or within a team-based follow-up forum. Regarding the allocation of Diamonds, these were awarded based on the specific complexity of each Mission. To strike an optimal balance between the entertainment value inherent to video games and the formal academic responsibilities dictated by the regulations and standards applicable to Mexican educational programs, a conversion matrix linking Diamonds to formal numeric grades was developed, adhering to the criteria established by Kingsley and Grabner-Hagen (2018).

Given that this was a blended learning course designed around gamification strategies and a medieval narrative, the Classcraft platform was selected to enhance the student experience. This platform allowed participants to operate within an online ecosystem rich in visual and stylistic elements consistent with the theme, effectively eliciting the experiential feel of a video game. Additional gami-

fied design elements that did not interfere with the core academic curriculum—such as avatars, in-game currency, powers, health points, and pets—were included to create an immersive and motivating environment that enriched the innovative learning process (Sandoval and Lamb, 2023). The ILE was structured so that students were required to complete missions as a cohesive team to unlock subsequent levels, thereby fostering a robust sense of progression and collective achievement (Kapp, 2012; Werbach and Hunter, 2020).

2.2 Participants

A total of 128 university students enrolled at the host institution participated in the course. A non-probabilistic convenience sampling technique (Golzar et al., 2022) was utilized, as participation in the study was entirely voluntary. The participants were distributed into four distinct classroom groups: Group A (29 students), Group B (34 students), Group C (32 students), and Group D (33 students). Regarding the demographic profile of the sample, 82% of the participants were women, and the age range across the entire cohort was between 29 and 33 years. Within each respective group, participants were instructed to form self-selected work teams consisting of four to five members to execute the collaborative course activities.

2.3 Data Collection Instruments and Techniques

To collect quantitative data, the Constructivist On-Line Learning Environment Survey (COLLES; Taylor and Maor, 2000) was deployed to assess the constructivist learning environment and online collaborative learning dynamics (Sulisboro and Santyasa, 2018), thereby measuring the impact of gamification strategies on students' collaborative learning. This instrument is widely recognized for its robust validity and reliability in technology-mediated educational contexts, as demonstrated by the research of Azhari et al. (2020), Kumar et al. (2022), and Rivero (2018), which report Cronbach's alpha values ranging between 0.80 and 0.90, indicating high internal consistency.

The questionnaire comprises 24 items evenly distributed across six dimensions of collaborative

learning: Relevance, Reflective Thinking, Interactive Analysis, Instructor Support, Peer Support, and Interpretation, allowing for a comprehensive self-assessment of performance within a collaborative environment (Dougiamas and Taylor, 2014). Notably, these dimensions directly align with the research objectives, as they evaluate student participation, peer interaction, instructor perception, the significance of learning activities, and the overall value of the course content achieved through gamification strategies. The COLLES instrument was administered as a pre-test and post-test at the beginning and conclusion of the course during July–August 2024, utilizing Google Forms for digital distribution. To ensure ethical compliance, students were only required to respond to the construct items; no identifying information regarding the participants or their host institution was collected.

To gather qualitative data, individual semi-structured interviews were conducted using a protocol consisting of eight open-ended questions. This approach allowed for an in-depth exploration of the participants' experiences, the identification of the level of collaboration and commitment among team members, and the determination of whether the gamification strategies utilized were meaningful for intra-team collaborative learning. The interview protocol underwent a rigorous validation process by an expert panel comprising ten specialists in education, collaborative learning, and innovative instructional strategies, thereby ensuring qualitative validity and reliability (Schwartz and Lederman, 2008).

The sampling strategy for identifying the key informants (Moka et al., 2021) to be interviewed was based on purposive criteria, including their level of engagement with the team, willingness to collaborate, proactive participation during activities, time spent on the platform, character development within the gamified environment, and communication skills. The instructor selected participants who consistently fulfilled all established criteria. Ultimately, four key informants were chosen—one from each classroom group—and assigned pseudonyms to preserve their anonymity during the research process. The chosen pseudonyms were Jesús, Carlos, Mariana, and Carolina.

2.4 Data Processing

Responses from the COLLES instrument were systematically compiled into a structured database for statistical analysis. To evaluate changes over time, a comparison of means between the pre-test and post-test scores was conducted utilizing a paired-samples t-test across all six dimensions. Statistically significant differences were determined based on a threshold of $p < .05$ (Rubio-Hurtado and Berlanga-Silvente, 2012). Additionally, a non-parametric Kruskal-Wallis H test was deployed to compare means across the four independent classroom groups, evaluating both overarching scores and individual COLLES dimensions (van der Linden, 2022). Quantitative data analysis was operationalized using IBM SPSS Statistics version 22.

Concurrently, the qualitative interviews were audio-recorded and verbatim transcribed into text files. Utilizing these transcripts, an inductive coding process was performed following the grounded theory methodology established by Corbin and Strauss (2008). The emerging codes were iteratively grouped, mapped, and linked to generate cohesive

axial categories (Palacios, 2021), culminating in the selection of primary core categories that comprehensively explained the qualitative interview findings. ATLAS.ti version 25 software was utilized to facilitate the coding, grouping, and categorization of the qualitative data.

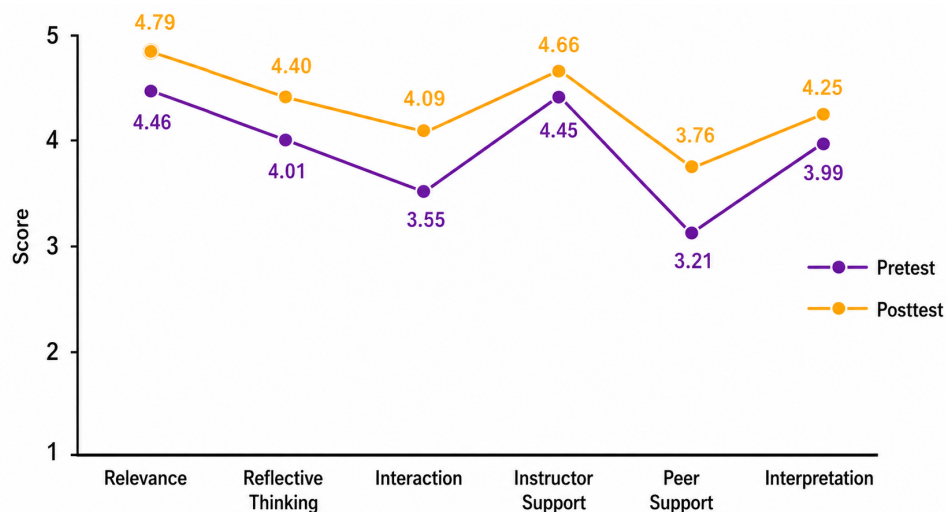
3. Results

Based on the procedures detailed in the methodological section, this section presents the primary findings derived from the analysis of both the quantitative and qualitative data.

3.1 Quantitative Data

A descriptive analysis revealed that the mean scores for all dimensions assessed by the COLLES instrument increased from the pre-test to the post-test. From the participants' perspective, this upward trend indicates an overall optimization of the constructivist learning environment resulting from the gamification intervention, as illustrated in Figure 2.

Figure 2. Means for the COLLES survey dimensions



Note: Created by the authors.

It is noteworthy that the Peer Support dimension demonstrated the most pronounced impact between the pre-test and post-test administrations, suggesting a high degree of meaningful collaboration within teams throughout the academic period.

Concurrently, the Instructor Support dimension yielded the highest absolute mean values (pre-test approx 4.45 and post-test approx 4.66), confirming that the instructor maintained consistent guidance and attentiveness toward the students during

the course. Furthermore, the Interactive Analysis dimension exhibited the greatest descriptive difference between the pre-test and post-test scores, indicating that the gamified intervention substan-

tially enhanced students' perception of the level of active participation and communication among participants.

Table 1. *Pre-test and post-test analysis for each dimension*

Dimension	Δ post-pre	ds pre-test	ds posttest	t	p	d
Relevance	.33203	0.489	0.328	5.949	.001	0.8
Reflective Thinking	.39258	0.652	0.539	5.255	.001	0.6
Interaction	.54883	0.942	0.960	4.338	.001	0.5
Tutor Support	.20898	0.606	0.445	2.963	.004	0.4
Support from Peers	.56055	1.034	1.053	4.372	.001	0.5
Interpretation	.25586	0.670	0.655	2.944	.004	0.3

Note: Δ = Mean, ds = Standard deviation, d = Effect size, where 0.2 is small, 0.5 is medium, and 0.8 is large.

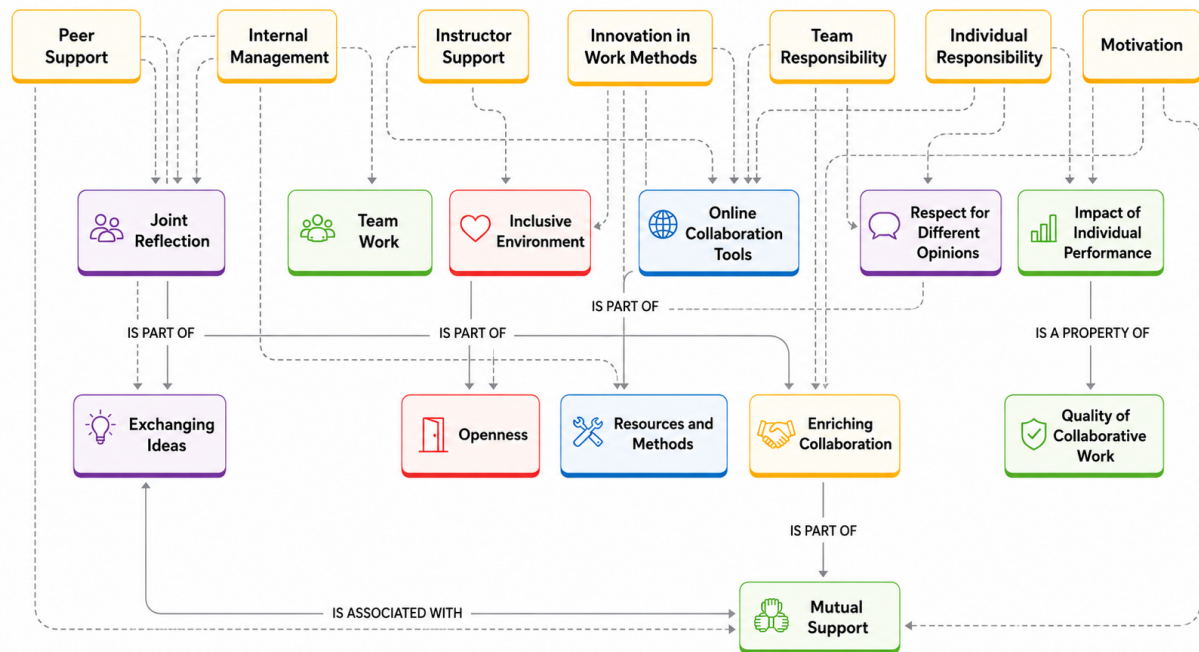
Author's own calculations.

It can be observed that all dimensions yielded a t-value greater than the critical threshold and a statistically significant value of $p < .05$, confirming definitive differences between the pre-test and post-test scores. In particular, the Relevance and Reflective Thinking dimensions exhibited the largest effect sizes; this outcome may be attributed to the fact that, during the pre-test, participants were unacquainted with how the instructional dynamics would unfold, whereas by the conclusion of the course, they were able to develop critical thinking and recognize the professional importance of the thematic areas. In the case of the Interactive Analysis and Peer Support dimensions, the observed effect sizes were moderate, suggesting that the gamification strategies exerted a meaningful impact on the teams' collaborative work dynamics. Finally, the smallest effect sizes were reported in the Instructor Support and Interpretation dimensions, indicating that the instructor's guidance and the communication processes among participants were perceived as highly important from the very beginning of the course and were subsequently reaffirmed at its conclusion.

When comparing the four independent classroom groups, the data revealed that the scores remained statistically homogeneous across most dimensions. However, within the Instructor Support dimension, Group B demonstrated significant differences compared to the other cohorts ($H = 15.126$, $p = .001$). Similarly, when scores were compared on the basis of gender, no statistically significant differences were detected between the groups.

3.2 Qualitative Data

The interviews conducted with the key informants provided deeper qualitative insights into the specific impacts of gamification strategies on their collaborative learning processes. The inductive coding process identified seven main categories that are interrelated through various conceptual dynamics (see Figure 3). These core categories comprise: Peer Support, Internal Management, Instructor Support, Innovation in Work Methods, Team Responsibility, Individual Responsibility, and Motivation.

Figure 3. Mapping of the categories and codes resulting from the interviews

Note: Prepared by the authors.

For each of these categories, the corresponding analysis was conducted, as presented below.

3.2.1 Peer Support

During the interviews, participants reported observing a high degree of peer support and collaboration both within their own teams and across different classroom groups, which actively enabled them to achieve common pedagogical objectives and goals. They also highlighted the role of constant communication, particularly during the execution of the gamified Missions within each team. Participants noted that this fluid dynamic allowed them to dynamically assume different roles throughout the course, providing them with the opportunity to engage in diverse and enriching learning experiences. Furthermore, the informants agreed that each team member contributed with distinct individual skills, which in turn fostered collaborative synergy and sound decision-making. Both Jesús and Carolina specifically mentioned that teamwork grounded in mutual respect, a balanced distribution of tasks, peer support, and the collective commitment of all members significantly strengthened communication channels both at the intra-team and inter-team levels.

3.2.2 Internal Management

In the interviews, participants agreed that both team leaders and members proactively took steps to organize themselves, improve coordination, and ensure the optimal functioning of the group. They highlighted the importance of shared responsibility and the active utilization of digital communication tools to execute their tasks. Additionally, it was noted that the capacity for internal conflict management and reaching consensus directly helped improve the quality of the assigned missions and projects. Both Carlos and Carolina explicitly stated that their teammates were highly motivated to collaborate, working together seamlessly via video conferences and face-to-face sessions through the specific instructional mechanisms employed by the professor.

3.2.3 Instructor Support

The interviewees rated the strategies employed by the instructor to foster teamwork as highly positive, highlighting how each member contributed autonomously while remaining under the instructor's continuous supervision. Another aspect they emphasized was the consistent collaborative approach, which, in

their opinion, proved to be significantly more engaging and less tedious than they had initially anticipated. They also noted that the gamification design represented a new pedagogical experience, viewing it positively due to the way it allowed them to tackle academic activities as a cohesive team. Both Jesús and Carlos agreed that the operational delivery of the course effectively incentivized collective efforts, highlighting how their participation was positively influenced by the instructor's proactive attitude as he guided them during the execution of the Missions. In this regard, Carlos commented:

What I liked was that the instructor kept an eye on everyone, asked if we had any questions, responded immediately after we submitted a question, and helped clarify what needed to be done.

3.2.4 *Innovation in the Teaching Method*

Another element the participants highlighted was the implementation of an innovative methodology such as gamification, as they collectively agreed that it transformed the traditional teaching paradigms they were accustomed to into a more engaging and stimulating experience. However, they concurrently noted that they were previously unaware that such methodologies existed or could be systematically deployed to enhance learning outcomes. In this regard, Mariana articulated this perspective through the following testimony:

I think it's great that we do something different in class, because it doesn't feel like I'm doing schoolwork, but rather playing a character. For example, I was a warrior, and to gain some power, I had to unlock the Missions together with the other teammates.

3.2.5 *Individual Responsibility*

Another theme that emerged from the interviews was how these innovative methodologies actively strengthened collaborative work while simultaneously emphasizing that individual accountability remains essential to achieving collective goals. Furthermore, participants noted that the personal differences, unique capabilities, and distinct skill sets of the team members significantly enriched

mutual collaboration and learning outcomes. They also acknowledged that, although the professional and personal obligations of certain members initially hindered the coordination of meetings and the timely completion of the Missions, a sustained individual commitment ultimately enabled them to deliver the tasks on time and in accordance with the established requirements. Carolina noted that the implementation of gamification strategies profoundly transformed the group's work dynamics. For her part, Mariana pointed out that while team members had to invest considerable effort into communication and intra-team collaboration, the final outcomes were highly satisfactory.

3.2.6 *Team Responsibility*

Building on the previous point, participants acknowledged that the collaborative activities embedded within the course systematically fostered mutual support, while the integration of gamification allowed them to explicitly recognize the ludic dimension of collaboration and learning. In the participants' estimation, although initial group work presented coordination challenges, they agreed that they ultimately achieved adequate synchronization. This success was driven by a collective commitment to the team, which was sustained through specific strategies proposed by the instructor, such as active listening and mutual respect for diverse ideas. Carlos articulated this experiential progression in the following comment:

My classmates and I reached agreements on teamwork because we noticed some shortcomings at the beginning of the course; so, we all talked it over and committed to working together to move the team forward and successfully complete the course.

3.2.7 *Motivation*

This was a recurring theme throughout the interviews, as participants consistently observed behavioral shifts when students successfully achieved both collective and individual goals. Specifically, they identified how the gamification strategies directly influenced collaborative learning dynamics, motivation, and overall attitude, noting that the systematic use of rewards proved both exciting and stimulating.

Furthermore, they perceived the missions and the broader Interactive Learning Event (ILE) as highly relevant to their professional training. The following testimony from Carolina reflects this perspective:

I did find motivation in the course because it was not routinary and made me curious about how I would achieve the goals with my team. I view the shift from the traditional focus on assignments and grades to games and leveling up as positive, as I believe it fostered interaction and motivation among classmates.

This feeling was reinforced by Carlos, who commented on his own attitude:

It changed my perception of the subject; I felt motivated by the competition and the chance to surpass myself and my classmates.

4. Discussion and Conclusions

4.1 Discussion

Based on the empirical analysis of the data, significant positive impacts of gamification strategies on collaborative learning were identified among higher education students within a blended learning environment. The most pronounced variations were observed in the COLLES survey results between the pre-test and post-test administrations, with inferential effect sizes indicating consistent, robust improvements following the instructional intervention. Furthermore, the qualitative interviews with key informants successfully triangulated, confirmed, and provided deeper insights into the underlying mechanisms driving these quantitative enhancements.

First, a paramount factor was the comprehensive structural design of the course, which systematically deployed well-defined gamification strategies while meticulously maintaining a pedagogical equilibrium with formal academic obligations. This rigorous design enabled students to clearly grasp the instructional nature of the course and its core professional purpose, a result reflected in the high baseline and final scores obtained in the Relevance dimension of the COLLES survey across both administrations. This finding aligns with the theoretical frameworks of Kapp (2012), Werbach and Hunter (2020), and Grabner-Hagen and Kingsley

(2023), who contend that a well-calibrated gamified environment triggers intrinsic psychological processes of motivation and sustained commitment toward overarching learning objectives.

Second, another critical factor that fostered a high level of collaborative learning was the participants' progressive commitment to engaging in the assigned tasks. Although the quantitative survey revealed moderate effect sizes in the Peer Support and Interactive Analysis dimensions, the qualitative testimonies of the key informants successfully illuminated these findings. The interviews demonstrated how fluid communication, shared responsibility, joint problem-solving, and alignment with collective objectives were progressively achieved. Nevertheless, these dynamics were not without friction, particularly regarding initial challenges in reaching consensus and managing task allocation within the teams, a phenomenon that converges with the observations of Parlier et al. (2022) and Ertan and Arkün (2022) concerning the complexities of uneven workload distribution in collaborative student frameworks.

Third, and fundamental to the operational success of the course, was the nature of the instructor's guidance. Both the quantitative and qualitative datasets heavily underscored the instructor's proactive engagement, continuous monitoring of the teams, and the academic trust placed in the students to execute their tasks autonomously. According to Campbell et al. (2024), specialized instructor support frequently exerts a more critical impact on shaping student perceptions than peer support within a technology-mediated learning environment. This is especially true in blended ecosystems, where the virtual component poses greater instructional management challenges than face-to-face interactions (Ingrisch-Rupp and Symeonidis, 2025). However, the statistically significant variation detected in Group B regarding the Instructor Support dimension highlights the necessity of examining confounding variables such as specialized teacher attitudes, the granular quality of formative feedback, and idiosyncratic group dynamics. Both Christopoulos and Mystakidis (2023) and Perez-Aranda et al. (2024) concur that these specific instructional elements directly mediate the efficacy of collaborative learning outcomes.

Finally, the convergence of the elements described above proved essential for driving the substantial effect sizes observed in the Relevance and

Reflective Thinking dimensions, which were also vividly mirrored in the qualitative narratives of the key informants. Consequently, the gamified intervention exerted a meaningful impact on cultivating an environment highly conducive to collaborative reflection, while simultaneously constructing more participatory and meaningful learning experiences—a outcome strongly supported by recent literature on innovative higher education methodologies (Amirthalingam et al., 2023; Guijarro-Romero et al., 2025; Qiao et al., 2025).

4.2 Conclusions

This study has empirically demonstrated that the systematic integration of gamification strategies actively influences group work dynamics and exerts a profoundly positive impact on collaborative learning among higher education students. This overarching finding is robustly substantiated by the statistical advancements observed between the pre-test and post-test scores across all dimensions of the COLLES instrument and is further validated by the rich qualitative narratives of the key informants, who emphasized substantial cognitive growth, particularly within the realms of reflective thinking and professional relevance.

The comprehensive analysis reveals that the factors vital to achieving meaningful collaborative learning are threefold. First, it requires an intentional course design that embeds a ludic instructional architecture specifically tailored to the discipline, academic level, and demographic profile of the students. Second, it hinges upon the students' internal accountability and active engagement in group activities, paired with a willingness to embrace collective reflection, mutual commitment, and autonomous conflict resolution. Lastly, the instructor remains an indispensable catalyst for securing these positive outcomes; therefore, the educator must maintain proactive involvement throughout the academic period, providing continuous formative feedback and scaffolding to operate effectively as a facilitator within the innovative learning ecosystem.

4.3 Recommendations for Future Work

Based on the scope and boundaries of this research, it is highly recommended that future stu-

dies incorporate additional assessment strategies to supplement the self-reported instruments used here. Specifically, the integration of maximum-performance tests is suggested to objectively evaluate students' concrete skills and cognitive capabilities within collaborative settings across both face-to-face and virtual environments. Likewise, deploying alternative validated instruments specifically calibrated for blended learning ecosystems would broaden the empirical understanding of these dynamics, as would examine the integration of artificial intelligence (AI) as a tool to scaffold or analyze collaborative processes. Furthermore, a key behavioral vector that warrants deeper longitudinal investigation is the complex construct of student motivation and its direct, mediated effects on collaborative learning outcomes. Finally, future research designs should scale the sample size to include a larger and more diverse cohort of participants; maintaining the same educational level while drawing from distinct institutional and socio-cultural contexts will enable cross-contextual validation and the identification of macro-level patterns that could not be detected in the present study due to the highly controlled nature of the course and the baseline homogeneity of the sample.

Bibliographic References

- Adukaite, A., Van Zyl, I., Er, Ş. and Cantoni, L. (2017). Teacher perceptions on the use of digital gamified learning in tourism education: The case of South African secondary schools. *Computers & Education*, (111), 172-190.
<https://doi.org/10.1016/j.compedu.2017.04.008>
- Alcívar, M. and Chancay, C. (2023). El aprendizaje colaborativo como estrategia didáctica para la aplicación de la gamificación en el aula de clases. UNESUM-Ciencias. *Revista Científica Multidisciplinaria*, 7(1), 4-16.
<https://doi.org/10.47230/unsum-ciencias.v7.n3.2023.720>
- Amirthalingam, S., Ramasamy, S. and Aznal, S. (2023). Gamification through collaborative learning in medical education. *The Asia Pacific Scholar*, 8(3), 45-49.
<https://doi.org/10.29060/TAPS.2023-8-3/SC2921>
- Aparicio-Gómez, O.-Y., Ostos-Ortiz, O.-L. and Abadía-García, C. (2024). Convergence between emerging technologies and active methodologies in the university. *Journal of Technology and Science Education*, 14(1), 31.
<https://doi.org/10.3926/jotse.2508>

- Azhari, F., Jasmi, N., Abd, M., Mohd, S., Lee, K. and Ming, L. (2020). Students' perceptions about social constructivist learning environment in E-learning. *Indian Journal of Pharmaceutical Education and Research*, 54(2), 271-278. <https://doi.org/10.5530/ijper.54.2.31>
- Burchart, M. and Haake, J., (2024) Supporting Collaborative Writing Tasks in Large-Scale Distance Education. *IEEE Transactions on Learning Technologies*, 17, 1051-1068. <https://doi.org/10.1109/TLT.2024.3355791>
- Campbell, L., Gray, S., Dey, D., Holt, D. and Mulholland, R. (2025). 'Their best interests at heart': exploring influences on student teachers' learning to promote health and wellbeing in the classroom. *Teacher Development*, 29(4), 649-667. <https://doi.org/10.1080/13664530.2024.2431574>
- Christopoulos, A. and Mystakidis, S. (2023). Gamification in Education. *Encyclopedia*, 3(4), 1223-1243. <https://doi.org/10.3390/encyclopedia3040089>
- Corbin, J. and Strauss, A. (2008). *Basics of Qualitative Research (3rd ed.): Techniques and Procedures for Developing Grounded Theory*. SAGE Publications, Inc. <https://doi.org/10.4135/9781452230153>
- Deterding, S., Dixon, D., Khaled, R. and Nacke, L. (2011). From game design elements to gamefulness: Defining "gamification". *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments*, 9-15. <https://doi.org/10.1145/2181037.2181040>
- Dewi, I. P., Asnur, L. and Ambiyar. (2023). Gamification: learning outcomes with game elements. En Ambiyar, U. Verawardina y O. Dakhi (eds.), *Proceedings of the 9th International Conference on Technical and Vocational Education and Training (ICTVET 2022)* (Vol. 747, pp. 96-107). Atlantis Press SARL. https://doi.org/10.2991/978-2-38476-050-3_11
- Dewi, S. V. and Wahyu, R. (2026). Metacognitive disparities Among similar learners: A study on learning styles. *International Journal of Research in Education and Science (IJRES)*, 12(1), 35-53. <https://doi.org/10.46328/ijres.5060>
- Dijkstra, F., Grijpma, J., de la Croix, A., van Schuppen, H., Meeter, M. and Renden, P. (2025). Challenge or threat? A Q-methodological study into nursing students' perceptions on learning to collaborate under stress. *Nurse Education Today*, 146, 106534, <https://doi.org/10.1016/j.nedt.2024.106534>
- Dougiamas, M. and Taylor, P. (2014). *Interpretive analysis of an internet-based course constructed using a new courseware tool called Moodle*. <https://dougiamas.com/archives/herdsa2002/>
- Du, S., Zhou, W., Wu, D. and Fei, M. (2025). Learning-based collaborative optimization for multi-objective energy-aware distributed assembly blocking flow shop scheduling. *Computers & Industrial Engineering*, 206, 111214. <https://doi.org/10.1016/j.cie.2025.111214>
- Durán, C. and Rosado, A. (2023). Aprendizaje activo e innovación en estudiantes de ingeniería. *Revista colombiana de tecnologías de avanzada*, 1(35), 127-135. <https://doi.org/10.24054/rcta.v1i35.52>
- Elsawah, W. (2025). Exploring the effectiveness of gamification in adult education: A learner-centric qualitative case study in a dubai training context. *International Journal of Educational Research Open*, 9, 100465, 1-10. <https://doi.org/10.1016/j.ijedro.2025.100465>
- Ertan, K. and Arkün, S. (2022). Gamification design to increase motivation in online learning environments: a systematic review. *Journal of Learning and Teaching in Digital Age*, 7(2), 151-159. <https://doi.org/10.53850/joltida.1020044>
- Firdaus, F., Fadhli, R. and Abidin, Z. (2023). Promoting collaborative learning in elementary mathematics through the use of gamification flipbooks: a mixed-methods study. *International Journal of Instruction*, 16(4), 987-1008. <https://doi.org/10.29333/iji.2023.16454a>
- Forni, P. and Grande, P. (2020). Triangulación y métodos mixtos en las ciencias sociales contemporáneas. *Revista Mexicana de Sociología*, 82(1), 159-189. <https://doi.org/10.22201/iis.01882503p.2020.1.58064>
- Hicks, N., Millar, R., Girling, L., Cummins, P. and Yamashita, T. (2021). Conducting virtual qualitative interviews with international key informants: insights from a research project. *The Qualitative Report*, 26(9), 2857-2871. <https://doi.org/10.46743/2160-3715/2021.4909>
- Grabner-Hagen, M. and Kingsley, T. (2023). From badges to boss challenges: Gamification through need-supporting scaffolded design to instruct and motivate elementary learners. *Computers and Education Open*, 4. <https://doi.org/10.1016/j.cao.2023.100131>
- Guijarro-Romero, S., Mayorga-Vega, D., Casado-Robles, C. and Viciania, J. (2025). Effect of a gamified-based intermittent teaching unit in Physical Education on schoolchildren's accelerometer-measured weekly physical activity: A cluster-randomized controlled trial. *School-fit study. Revista de Psicodidáctica*, 30(1), 500156. <https://doi.org/10.1016/j.psicoe.2024.500156>
- Gómez, J., Arias, L., Chiappe, A. and Ortega, E. (2025). Gamifying Learning with AI: A Pathway

- to 21st-Century Skills. *Journal of Research in Childhood Education*, 39(4), 735-750.
<https://doi.org/10.1080/02568543.2024.2421974>
- Golzar, J., Noor, S. and Tajik, O. (2022). Convenience Sampling. *International Journal of Education & Language Studies*, 1(2), 72-77.
<https://doi.org/10.22034/ijels.2022.162981>
- Idoiaga, N., Beloki, N. and Yarritu, I. (2024). Active methodologies in Higher Education: reasons to use them (or not) from the voices of faculty teaching staff. *High Educ.*, 88, 919-937.
<https://doi.org/10.1007/s10734-023-01149-y>
- Ingrisch-Rupp, C. and Symeonidis, V. (2025). The multifaceted field of virtual exchanges in teacher education: A Literature Review. *Center for Educational Policy Studies Journal*, 15(1), 59-82.
<https://doi.org/10.26529/cepsj.1741>
- Karkoulin, S. (2025). Boosting faculty engagement: the cultural and gender dynamics of gamification in universities. *Cogent Education*, 12(1), 2539216.
<https://doi.org/10.1080/2331186X.2025.2539216>
- Kapp, K. (2012). *The Gamification of Learning and Instruction*. Pfeiffer.
- Kingsley, T. and Grabner-Hagen, M. (2018). Vocabulary by Gamification. *The Reading Teacher*, 71(5), 545-555. <https://doi.org/10.1002/trtr.1645>
- Kumar, J., Richard, R., Osman, S. and Lowrence, K. (2022). Micro-credentials in leveraging emergency remote teaching: The relationship between novice users' insights and identity in Malaysia. *International Journal of Educational Technology in Higher Education*, 19(1), 18.
<https://doi.org/10.1186/s41239-022-00323-z>
- Kumar, R. (2026). Value co-creation in AI-influenced management education: Gamification as a relational mechanism. *The International Journal of Management Education*, 24(3).
<https://doi.org/10.1016/j.ijme.2026.101425>
- Lan, X. and Song, B. (2025). The more, the merrier? Investigating the distinct and interaction effects of gamification mechanics in corporate sustainability engagement. *Journal of Business Research*, 199.
<https://doi.org/10.1016/j.jbusres.2025.115513>
- Lee, J., Lim, R., Mohamad, F., Chan, K. G. and Mas'ud, F. (2023). Collaborative creativity among undergraduate students as game creators during gamification in a university-wide elective course. *Journal of University Teaching & Learning Practice*, 20(1).
<https://ro.uow.edu.au/jutlp/vol20/iss1/16>
- Lovakov, A. and Agadullina, E. (2021). Empirically derived guidelines for effect size interpretation in social psychology. *European Journal of Social Psychology*, 51(3), 485-504. <https://doi.org/10.1002/ejsp.2752>
- Maraza-Quispe, B., Choquehuanca-Quispe, W., Rosas-Imán, V. H., Quispe-Flores, L. M., Alcázar-Holguin, M. A., Feliciano-Yucra, G. and Martinez-Lopez, A. C. (2024). Impact of gamification on collaborative learning development: a quantitative experimental approach. *IEEE Revista Iberoamericana de Tecnologías del Aprendizaje*, 19, 51-60.
<https://doi.org/10.1109/RITA.2024.3368360>
- Malvasi, V. and Recio-Moreno, D. (2022). Percepción de las estrategias de gamificación en las escuelas secundarias italianas. *Alteridad*, 17(1), 50-63.
<https://doi.org/10.17163/alt.v17n1.2022.04>
- Martínez, E., Pegalajar, M. and Burgos-García, A. (2023). Active methodologies and curricular sustainability in teacher training. *International Journal of Sustainability in Higher Education*, 24(6), 1364-1380.
<https://doi.org/10.1108/IJSHE-05-2022-0168>
- Mendes, D., Lima, M. and Freitas, T. (2022). Gamificación, "No tengo ni idea de lo que es": un estudio en la Formación Inicial del Profesorado de Educación Física. *Alteridad*, 17(1), 12-23.
<https://doi.org/10.17163/alt.v17n1.2022.01>
- Palacios, O. (2021). La teoría fundamentada: Origen, supuestos y perspectivas. *Intersticios Sociales*, 22.
<https://doi.org/10.55555/IS.22.332>
- Parlier, T., Rocconi, L., Skolits, G. and Davidson, C. (2022). The effect of learning community participation on community college students' perceptions of learning gains and engagement. *Community College Journal of Research and Practice*, 46(4), 272-283.
<https://doi.org/10.1080/10668926.2020.1852983>
- Li, C., Memmert, D. and Sang, G. (2026) Flowing toward toughness: serial mediation of flow and mental toughness in gamified XR soccer instruction. *Front. Psychol.* 17, 1731891.
<https://doi.org/10.3389/fpsyg.2026.1731891>
- Perez-Aranda, J., Medina-Claros, S. and Urrestarazu-Capellán, R. (2024). Effects of a collaborative and gamified online learning methodology on class and test emotions. *Education and Information Technologies*, 29(2), 1823-1855.
<https://doi.org/10.1007/s10639-023-11879-2>
- Prieto-Andreu, J. (2024). Cómo evitar efectos negativos al gamificar en educación: revisión panorámica y aproximación heurística hacia un modelo instruccional. *Multidisciplinary Journal of Educational Research*, 14(2), 244-266.
<https://doi.org/10.17583/remie.11765>
- Qiao, S., Yeung, S., Shen, X., Leung, T., Ng, T. and Chu, S. (2024). How competitive, cooperative, and collaborative gamification impacts student learning and engagement—Language Learning and Technology. *Language Learning & Technology*, 28(1), 1-19.

- Restrepo-Tamayo, L., Gasca-Hurtado, G., Machuca-Villegas, L. and Morillo-Puente, S. (2025) Relationship between gamification elements and social and human factors using the simple additive weighting method. *PLoS ONE* 20(4): e0320419. <https://doi.org/10.1371/journal.pone.0320419>
- Rivero, M. (2018). Percepción estudiantil sobre la calidad de un ambiente de aprendizaje mixto apoyado por Moodle. *Pixel-Bit, Revista de Medios y Educación*, 53, 193-205. <https://doi.org/10.12795/pixelbit.2018.i53.13>
- Rubio-Hurtado, M. and Berlanga-Silvente, V. (2012). Com aplicar les proves paramètriques bivariades t de Student i ANOVA en SPSS. Cas pràctic. *REIRE Revista d'Innovació i Recerca en Educació*, 5(2), Article 2. <https://doi.org/10.1344/reire2012.5.2527>
- Sandoval, S. and Lamb, J. A. (2023). Gamification: the experiences of International Baccalaureate (IB) Teachers shared. *International Journal of Technology in Education*, 6(2), 187-202. <https://doi.org/10.46328/ijte.375>
- Schwartz, R. and Lederman, N. (2008). What scientists say: scientists' views of nature of science and relation to science context. *International Journal of Science Education*, 30(6), 727-771. <https://doi.org/10.1080/09500690701225801>
- Shilling, T., Thayer, J., Coria-Navia, A. and Ferguson, H. (2023). Student preferences for active learning and their beliefs, experiences, and knowledge. *Teaching and Learning in Communication Sciences & Disorders*, 7(2). <https://doi.org/10.30707/TLCSD7.2.1690393489.74901>
- Suaco, T., Mangaliag, A. and Gadgad, M. (2023). Collaborative summative assessment: means for enduring learning and attainment of 21st Century skills in the online platform. *Journal of Education and Learning*, 12(1), 118. <https://doi.org/10.5539/jel.v12n1p118>
- Sulisboro, D. and Santyasa, W. (2018). Maximize the mobile learning interaction through project-based learning activities. *Educational Research and Reviews*, 13(5), 144-149. <https://doi.org/10.5897/ERR2018.3463>
- Tafur-Méndez, F., Almao-Malvacias, V. and Zambrano-Chamba, M. (2023). Conocimiento sobre la gamificación como técnica para reforzar el aprendizaje en la educación superior. *593 Digital Publisher CEIT*, 8(3), 209-218. <https://doi.org/10.33386/593dp.2023.3.1628>
- Taylor, P. and Maor, D. (2000). *Assessing the efficacy of online teaching with the Constructivist online learning environment survey*. 9th Annual Teaching Learning Forum. <https://bit.ly/3LLalNs>
- Tupthong, K. and Chatwattana, P. (2025). Architecture of the micro-learning platform mixed with gamification via metaverse to promote creative problem-solving Skills. *Higher Education Studies*, 15(1), 150-159. <https://doi.org/10.5539/hes.v15n1p150>
- Tsang, Y., Man, C., Wu, C. and Li, Y. (2024) gamified blockchain education in experiential learning: an analysis of students' cognitive well-being. *IEEE Transactions on Education*, 67(4), 620-628. <https://doi.org/10.1109/TE.2024.3395617>
- van der Linden, W. (2022). Two statistical tests for the detection of item compromise. *Journal of Educational and Behavioral Statistics*, 47(4), 485-504. <https://doi.org/10.3102/10769986221094789>
- Wang, W., Wang, X., Li, S., Ma, T., Poni, M. and Sun, H. (2024). The relationship between emotional interaction and learning engagement in online collaborative learning: Moderated mediating effect. *Psychology in the Schools*, 61(4), 1549-1564. <https://doi.org/10.1002/pits.23125>
- Werbach, K. and Hunter, D. (2020). *For the win, revised and updated edition: the power of gamification and game thinking in business, education, government, and social impact*. Wharton School Press. <https://doi.org/10.2307/j.ctv2hdrfsm>

Author Declaration – CRediT Taxonomy

Authors	Contributions
Dr. William Reyes-Cabrera	Conceptualization, methodology, data curation, software, writing.
Dr. Samia Imán-May	Formal analysis, research, validation, writing of the original draft.

Statement on the Use of Artificial Intelligence

The authors DECLARE that, in the preparation of the article “*Gamification and Collaborative Learning Among Higher Education Students*,” the AI tool from the ATLAS.TI program was used to code and analyze the interviews, generating the list of codes; this can be seen in the results section under subsection 3.2 on qualitative data.