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Gamification as a pedagogical strategy to enhance cognitive, affective, and academic engagement in higher education

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ABSTRACT

This study investigates how gamification influences student engagement in fully distance higher education, distinguishing academic, cognitive, and affective engagement. Using survey data from 234 undergraduates, we tested a structural model linking motivational and social gamification components (motivation, teamwork, peer interaction, and teacher participation) to engagement outcomes. Results show that motivation predicts academic and cognitive engagement, while teacher participation is the strongest driver of affective engagement; affective engagement, in turn, strengthens cognitive engagement. Teamwork contributes positively across engagement dimensions, whereas peer interaction is not significant in this distance-learning context. By modeling engagement as a multidimensional construct and separating specific gamification components, this study clarifies why some gamified mechanisms work better than others online. Practically, effective gamified course design should prioritize instructor presence and structured teamwork alongside motivational elements to sustain engagement in virtual higher education.

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1. INTRODUCTION

Gamification has become an increasingly relevant pedagogical strategy in higher education, particularly in online and distance learning contexts where sustaining student engagement is a persistent challenge. Recent studies highlight that gamified learning environments can enhance motivation, participation, and academic persistence by integrating playful elements into instructional design [1], [2]. From the perspective of self-determination theory, gamification supports learning by reinforcing intrinsic motivation, which is a key driver of sustained engagement and academic effort [3]. Based on this premise, educators have highlighted the use of game-based elements such as points, levels, symbolic rewards, and immediate feedback to help students track their progress and stay engaged with learning tasks [4], [5]. Such dynamics transform learning activities into structured challenges that promote attention, self-regulation, and persistence in cognitively demanding contexts [1], [5]. Empirical evidence suggests that gamification, when meaningfully designed, contributes to both motivational and engagement-related outcomes in higher education [2], [6].

Beyond individual motivation, gamification has also been shown to enhance collaborative learning through teamwork-based activities. Research on gamification in collaborative higher education settings reports significant positive effects on cognitive and attitudinal outcomes, reinforcing peer accountability, shared responsibility, and social commitment [7], [8]. Narrative and team-based gamified activities require joint decision-making and collective problem-solving, encouraging students to negotiate, discuss, and co-construct solutions [9].

When peer evaluation and cooperative dynamics are integrated, gamification strengthens co-responsibility and engagement with common goals, positioning teamwork as a central social component of gamified learning [10].

Student engagement itself is widely recognized as a multidimensional construct in higher education. Academic engagement describes students' behavioral involvement in their learning tasks, persistence, and dedication to academic tasks, and has been strongly associated with learning success and retention [11]. In online and distance learning contexts, fostering academic engagement is especially critical because reduced social presence and limited real-time interaction can increase the risk of disengagement, making teaching strategies inefficient. In higher education, engagement is increasingly understood as an integrated construct that combines academic, cognitive, and affective dimensions, reflecting active participation in learning processes and responsiveness to instructional strategies such as gamification [12]. Operationally, academic engagement is reflected in timely task completion, participation in discussions and collaborative activities, and sustained effort when feedback is provided [2]. These behavioral indicators allow researchers and instructors to assess how students interact with learning activities and respond to pedagogical interventions in virtual learning environments.

Cognitive engagement describes students' investment of mental effort in the processes of understanding, analysis, and knowledge integration. Gamified learning environments promote cognitive engagement by incorporating progressive levels of difficulty and problem-solving challenges that stimulate analytical reasoning and deep processing [13]. Students immersed in gamified activities tend to process information more critically and integrate new knowledge more effectively, supporting long-term learning outcomes [14]. This sustained cognitive involvement is particularly relevant in online education, where learners must actively regulate their learning processes.

Affective engagement captures students' emotional involvement in learning activities, including interest, enjoyment, and positive attitudes toward academic tasks. In gamified environments, affective engagement is fostered through motivational dynamics, social interaction, and feedback mechanisms that generate positive emotional responses [15], [16]. Research has shown that teacher support and facilitation play a crucial role in shaping students' affective engagement, particularly in online learning contexts where social presence is limited [17], [18].

Although prior studies demonstrate that gamification can enhance engagement, many investigations treat gamification as a unified strategy, without distinguishing among its specific components or examining how these components influence different dimensions of engagement. Consequently, there is limited empirical evidence explaining why certain gamification mechanisms are more effective than others in fully distance higher education. This lack of differentiation limits the understanding of the specific pedagogical pathways through which gamification influences student engagement. Addressing this gap, the present study adopts a differentiated approach by examining how motivation through gamification, teamwork, peer interaction, and teacher participation relate to academic, cognitive, and affective engagement within a single structural model.

Grounded in self-determination theory [4] and supported by collaborative learning research [7], [8], this study seeks to clarify the distinct pathways through which gamification shapes engagement in online higher education. Drawing on this framework, the following hypotheses are proposed:

- H1. Affective engagement positively influences cognitive engagement
- H2. Motivation through gamification has a positive effect on academic engagement
- H3. Motivation through gamification has a positive effect on cognitive engagement
- H4. Peer interaction has a positive effect on affective engagement
- H5. Teacher participation has a positive effect on affective engagement
- H6. Teamwork through gamification has a positive effect on academic engagement
- H7. Teamwork has a positive effect on affective engagement
- H8. Teamwork has a positive effect on cognitive engagement

2. METHOD

2.1. Research design

A quantitative cross-sectional correlational approach was used to analyze the relationships between gamification components and student engagement in distance higher education. Data were collected through self-report questionnaires and analyzed to identify associations among latent constructs without manipulating variables, which is consistent with the exploratory and explanatory aims of the study. Data analysis was conducted using partial least squares structural equation modeling (PLS-SEM) with SmartPLS to examine predictive relationships among the study's latent constructs.

2.2. Participants and data collection

The sample consisted of 234 undergraduate students enrolled in fully distance learning programs at a private university in southern Peru. Participants were drawn from various academic programs, including social

work, accounting, secondary education, marketing and commercial management, international business administration, tourism and gastronomy, and music arts. Both male and female students participated, with ages ranging from 18 to 24 years, and were enrolled between the first and third year of their programs.

The selected university was chosen because it offers consolidated distance education programs that systematically integrate gamified activities into their virtual learning environments. This context provided an appropriate setting to examine how gamification mechanisms operate in authentic online higher education conditions. Additionally, the institutional emphasis on virtual pedagogy ensured consistent exposure of students to gamified learning strategies across courses. However, the sample was non-probabilistic and context-specific, and therefore the findings should be interpreted as representative of similar distance learning programs rather than generalizable to all higher education contexts. Data were collected using an online questionnaire administered during the academic term. Participation was voluntary, and the survey was accessible only to students enrolled in the selected programs at the time of data collection.

2.3. Instruments

Two previously validated instruments were employed in this study. Student engagement was assessed using the Higher Education Student Engagement Scale (HESES) [19], which measures engagement across three dimensions: academic engagement, cognitive engagement, and affective engagement. Each dimension includes eight items, resulting in a total of 24 items evaluated on a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

Motivational and collaborative components of gamification were measured using the questionnaire on motivation for cooperative playful learning strategies [20]. This instrument examines four dimensions: task motivation, learning, teamwork, and flow, and consists of 16 items rated on the same five-point Likert scale. Both instruments have shown satisfactory psychometric properties in their original validation studies. All items were reviewed for clarity and slightly adapted to align with the virtual learning environment, while maintaining their original meaning and validity. The online questionnaire required complete responses, and as a result, no missing data were observed.

2.4. Data analysis

Data analysis was conducted using PLS-SEM with the SmartPLS, following a two-step analytical procedure. This method was selected due to its suitability for predictive research and for analyzing complex models with multiple latent constructs. PLS-SEM is particularly appropriate for exploratory studies, as it does not require strict assumptions regarding data normality. First, the measurement model was evaluated to assess reliability and validity. Internal consistency was examined using Cronbach's alpha and composite reliability. Convergent validity was assessed through the average variance extracted (AVE), while discriminant validity was evaluated using the heterotrait-monotrait ratio (HTMT). Variance inflation factors (VIF) were also analyzed to identify potential collinearity issues among indicators. Second, the structural model was assessed using bootstrap procedures to test the significance of the path coefficients. Model quality was further evaluated using effect sizes (f^2), explained variance (R^2), and predictive relevance (Q^2). Given the cross-sectional design of the study, causal relationships were not inferred.

2.5. Ethical considerations

Before data collection, participants were informed about the purpose of the study and provided written informed consent. Participation was voluntary and anonymous, and no personally identifiable information was collected. The study procedures were conducted in accordance with institutional research guidelines and were approved by the relevant academic authority of the participating university.

3. RESULTS AND DISCUSSION

3.1. Descriptive results

Regarding the sociodemographic distribution of the participants, Table 1 indicates that the sample (n=234) is predominantly female (67.1%) compared to male participants (32.9%), revealing a gender imbalance toward female participation. By age, the 18-24 group predominates (68.8%), while the remaining age groups together account for 31.2% of the sample (25-30: 13.7%, 31-35: 8.5%, ≥36: 9.0%). These results indicate that the sample consisted predominantly of young adults enrolled in distance higher education programs.

By program, participants are concentrated in social work (20.1%) and music arts (18.8%), which together represent 38.9% of the sample. These are followed by accounting (15.8%), secondary education (14.1%), marketing and commercial management (13.7%), international business administration (11.1%), and tourism and gastronomy (6.4%). Overall, the results largely reflect the perspectives of young women from social and artistic academic fields.

Table 2 reveal that the overall engagement variable showed the highest mean score (M=102.91, SD=15.48), while total gamification also obtained a relatively high score (M=64.02, SD=11.60). At the dimensional level, teacher engagement exhibited a notably strong mean score (M=16.12, SD=3.43). In contrast, teamwork presented the lowest average score among the measured dimensions (M=11.43, SD=2.70).

Table 1. Sociodemographic distribution of participants.

Category	Item	n	%
Sex	Women	157	67.1
	Men	77	32.9
	Total	234	100.0
Age group	18-24 years	161	68.8
	25-30 years	32	13.7
	31-35 years	20	8.5
	36 years or older	21	9.0
	Total	234	100.0
Program	Social work	47	20.1
	Music arts	44	18.8
	Accounting	37	15.8
	Secondary education	33	14.1
	Marketing and commercial management	32	13.7
	International business administration	26	11.1
	Tourism and gastronomy	15	6.4
	Total	234	100.0

Table 2. Descriptive summary of research variables

Variable	Mean	Standard deviation
Learning	20.71	3.91
Teamwork	11.43	2.70
Flow	22.65	3.06
Academic engagement	31.89	4.98
Cognitive engagement	16.78	2.83
Teacher engagement	16.12	3.43
Peer engagement	21.17	5.15
Affective engagement	16.95	3.26
Total gamification	64.02	11.60
Total engagement	102.91	15.48

3.2. Measurement model and structural model

The original instruments comprised 24 items measuring student engagement (higher education scale, academic engagement, cognitive engagement, and affective engagement) and 16 items assessing motivation for cooperative playful learning strategies (motivation, learning, teamwork, and flow). Following item refinement in SmartPLS, only indicators with adequate standardized loadings and conceptual coherence were retained. As reported in Table 3, items that failed to meet reliability or discriminant validity criteria were removed. As a result of this refinement process, the flow and learning factors were excluded due to their conceptual overlap with motivation and their limited contribution to the structural model, leading to a more parsimonious specification. The retained constructs demonstrated strong indicator reliability and convergent validity, with satisfactory loadings across all dimensions, supporting the adequacy of the final measurement model.

The removal of the flow and learning factors reduced collinearity among initially overlapping dimensions, particularly with motivation, resulting in a cleaner and more stable measurement structure. This refinement contributed to improved convergent validity across constructs, as reflected in the AVE values reported in Table 4. As shown, all retained constructs demonstrated satisfactory internal consistency and convergent validity, meeting established thresholds for indicator loadings and AVE. These results confirm that the final measurement model preserves the essential content of each construct while achieving an adequate balance between reliability, validity, and parsimony.

Overall, the results reported in Table 4 confirm that all constructs exhibit adequate reliability and convergent validity. The internal consistency measures and variance explained by each construct meet established methodological standards, indicating that the measurement model is robust and methodologically adequate [21]. These findings provide empirical support for the suitability of the retained constructs for subsequent structural model analysis.

Discriminant validity was assessed using the HTMT criterion, which is considered a more robust approach than the traditional Fornell-Larcker method [21], [22]. As presented in Table 5, HTMT values do not exceed the conservative threshold of 0.85, demonstrating sufficient discriminant validity among constructs. In addition, collinearity was examined using the VIF. The obtained values did not exceed the recommended limit of 5.0 [23], indicating that multicollinearity is not a concern in the measurement model.

Table 3. Indicator loadings for each construct

Construct	Item	Loading
Affective engagement	AFFEC1	0.871
	AFFEC2	0.904
	AFFEC4	0.843
Peer engagement	PEER2	0.857
	PEER3	0.845
	PEER4	0.848
Academic engagement	ACAD2	0.702
	ACAD4	0.710
	ACAD5	0.779
	ACAD7	0.744
	ACAD8	0.747
Cognitive engagement	COGN1	0.863
	COGN2	0.867
	COGN3	0.858
	COGN4	0.820
Motivation	MOT1	0.889
	MOT3	0.924
	MOT4	0.875
Teacher engagement	TEACH1	0.890
	TEACH3	0.886
	TEACH4	0.893
Teamwork	TEAM1	0.941
	TEAM2	0.937

Table 4. Reliability and convergent validity measures

Construct	Cronbach's α	rho_A	CR	AVE
Academic engagement	0.790	0.796	0.856	0.543
Affective engagement	0.844	0.849	0.906	0.762
Cognitive engagement	0.874	0.874	0.914	0.726
Motivation	0.877	0.882	0.924	0.803
Peer engagement	0.816	0.859	0.887	0.723
Teacher engagement	0.869	0.872	0.919	0.791
Teamwork	0.865	0.866	0.937	0.881

Note: CR=composite reliability

Table 5. HTMT criterion for discriminant validity

Constructs	1	2	3	4	5	6	7
Academic engagement	—						
Affective engagement	0.666	—					
Cognitive engagement	0.779	0.737	—				
Motivation	0.603	0.545	0.616	—			
Peer engagement	0.479	0.491	0.568	0.269	—		
Teacher engagement	0.692	0.703	0.724	0.648	0.548	—	
Teamwork	0.500	0.584	0.618	0.647	0.555	0.539	—

Note: HTMT values do not exceed the 0.85 cutoff

The strength and significance of the proposed relationships were assessed using bootstrapping with 5,000 resamples. The results, summarized in Table 6, reveal a clear pattern of effects that largely support the proposed hypotheses. Overall, motivation through gamification emerged as a primary driver of student engagement, exerting a strong influence on academic engagement and a more moderate effect on cognitive engagement. In addition, a robust relationship was observed between affective and cognitive engagement, indicating that students' emotional involvement plays a central role in sustaining deeper cognitive effort.

These findings suggest that engagement in gamified distance learning environments is shaped not only by motivational mechanisms but also by the interaction between emotional and cognitive dimensions of learning. Affective engagement plays a mediating role by supporting sustained cognitive effort, emphasizing the relevance of gamified strategies that integrate emotional involvement and cognitive challenge.

Table 7 and Figure 1 indicate that the structural model provides meaningful explanatory power for the engagement dimensions. Teacher participation stands out as the most influential factor shaping affective engagement, emphasizing the importance of instructor presence in gamified distance learning environments. Teamwork also contributes positively to engagement, particularly at the affective level, while providing additional support to academic and cognitive engagement. These results suggest that collaborative gamified activities enhance engagement when they are structured and aligned with instructional goals. In contrast, peer interaction does not emerge as a significant determinant of affective engagement, indicating that informal peer communication alone may have limited impact in fully distance learning contexts.

Overall, the variance explained by the model, as reported in Table 7, reaches levels commonly regarded as moderate to substantial within the social sciences [24], supporting the adequacy of the proposed model for explaining engagement in gamified higher education. These results indicate that the selected predictors capture a meaningful proportion of variance in the different dimensions of engagement. Consequently, the structural model provides a solid empirical basis for interpreting the relationships between gamification mechanisms and student engagement.

Figure 1 presents the relationships among gamification components and student engagement dimensions. Standardized path coefficients and explained variance for the endogenous constructs are displayed, providing a clear visual summary of the direction and relative strength of the relationships identified in the model. This graphical representation facilitates the interpretation of the structural model by highlighting the most influential paths and the relative contribution of each predictor to student engagement.

Table 6. Path coefficients and statistical significance

Path	β (O)	t	p	Significance
AFFEC→COGN	0.430	5.576	0.000	*** p < .001
MOT→ACAD	0.408	6.691	0.000	*** p < .001
MOT→COGN	0.229	3.420	0.001	** p < .01
PEER→AFFEC	0.100	1.572	0.116	Not significant
TEACH→AFFEC	0.446	6.645	0.000	*** p < .001
TEAM →ACAD	0.188	3.059	0.002	** p < .01
TEAM→AFFEC	0.241	3.520	0.000	*** p < .001
TEAM→COGN	0.194	2.777	0.006	** p < .01

Note: AFFEC=affective engagement; PEER=peer engagement; ACAD=academic engagement; COGN=cognitive engagement; MOT=motivation; TEACH=teacher engagement; TEAM=teamwork; ***p<0.001; **p<0.01; and *p< 0.05.

Table 7. Explained variance (R^2) of endogenous constructs

Construct	R^2	t	p
Academic engagement	0.288	5.478	0.000
Affective engagement	0.435	6.604	0.000
Cognitive engagement	0.501	8.001	0.000

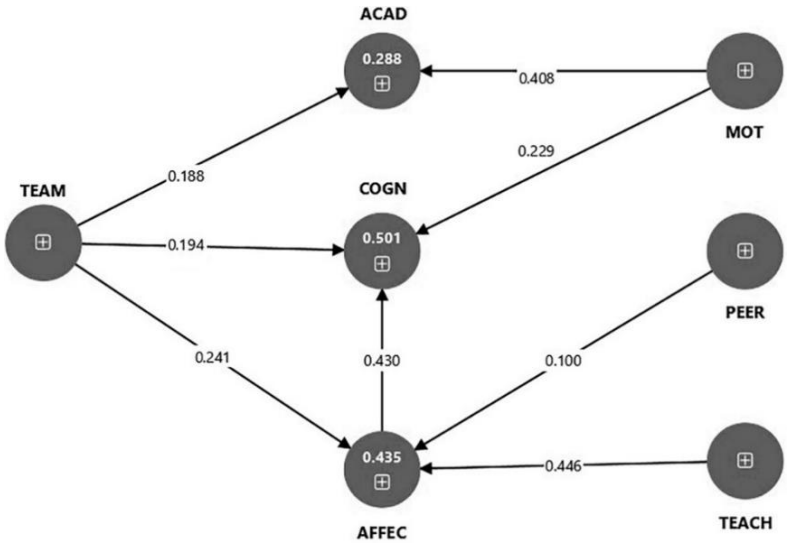

Figure 1. Structural model with standardized path coefficients and R^2 values

Table 8 summarizes the effect sizes of the exogenous constructs on the endogenous engagement dimensions. The results indicate that affective engagement and teacher participation show the strongest effects, both reaching a medium magnitude, highlighting their important role within the structural model. Motivation demonstrates a meaningful contribution to academic engagement, while its influence on cognitive engagement is comparatively smaller. Teamwork shows consistent but small effects across academic, affective, and cognitive engagement, suggesting a supportive rather than dominant role in shaping engagement outcomes. In contrast, peer engagement exhibits a negligible effect on affective engagement, reinforcing its limited contribution within the proposed model.

The PLSpredict procedure with cross-validation was used to assess out-of-sample predictive relevance. As reported in Table 9, the model consistently outperformed the benchmark indicator average approach across all engagement dimensions, indicating meaningful predictive capability. The predictive performance was moderate for academic engagement and strong for affective and cognitive engagement, suggesting that the model is particularly effective in predicting students' emotional and cognitive involvement in gamified distance learning contexts. At the overall level, the results indicate substantial predictive relevance, supporting the model's capacity to generalize beyond the estimation sample. Taken together, these findings confirm that the proposed model demonstrates not only adequate explanatory power but also satisfactory out-of-sample predictive performance. This reinforces the theoretical relevance and practical applicability of the model in line with established methodological recommendations [25].

Table 8. Effect size (f^2) of exogenous constructs on endogenous variables

Path	f^2	Effect size
AFFEC→COGN	0.258	Medium
MOT→ACAD	0.160	Medium
MOT→COGN	0.066	Small
PEER→AFFEC	0.012	Negligible
TEACH→AFFEC	0.242	Medium
TEAM →ACAD	0.034	Small
TEAM→AFFEC	0.072	Small
TEAM→COGN	0.046	Small

Note: AFFEC=affective engagement; PEER=peer engagement; ACAD=academic engagement; COGN=cognitive engagement; MOT=motivation; TEACH=teacher engagement; and TEAM=teamwork.

Table 9. Out-of-sample predictive relevance using PLSpredict (CVPAT-LV)

Construct	PLS loss	IA loss	Δ loss	t	p	Predictive power
Academic engagement	0.670	0.776	-0.106	3.367	0.001	Medium
Affective engagement	0.618	0.896	-0.278	4.829	0.000	Strong
Cognitive engagement	0.473	0.697	-0.225	5.057	0.000	Strong
Overall model	0.591	0.780	-0.189	5.604	0.000	Substantial

3.3. Discussion

The present study examined how gamification influences different dimensions of HESES by testing a structural model that integrates motivational, social, and affective-cognitive components. Overall, the findings support established theoretical frameworks and provide additional insight into how specific gamification mechanisms operate in fully virtual learning environments. Motivation emerged as a strong predictor of academic engagement and a more moderate predictor of cognitive engagement. This pattern is consistent with self-determination theory, which identifies motivation as a key driver of persistence and effort in demanding learning contexts [26]. Previous research has shown that gamified elements such as points, progress indicators, and feedback loops enhance students' sense of competence and achievement [1], [27]. Extending this line of evidence, the present study indicates that motivational mechanisms not only sustain participation but also facilitate deeper cognitive engagement, supporting conclusions reported in earlier studies [28].

Teamwork demonstrated a positive influence across academic, affective, and cognitive engagement, although its effects were comparatively modest. This finding aligns with research on collaborative learning in gamified environments, which highlights the role of structured collaboration in promoting both attitudinal and cognitive benefits [7], [8]. In particular, team-based and narrative-driven activities appear to foster shared decision-making and collective responsibility, reinforcing the integrative role of collaboration in strengthening student engagement [9], [10]. Teacher participation emerged as the strongest predictor of affective engagement, underscoring the central role of instructors in creating emotionally supportive learning environments [17], [18]. In gamified contexts, active teacher involvement in task design and game dynamics

aligned with learning objectives appears to foster positive emotional responses, including enthusiasm and enjoyment [15]. This finding reinforces the mediating function of affective engagement between motivational processes and continued academic participation [16].

Participant characteristics help explain the engagement patterns observed in this study. The sample consisted mainly of young adult and female undergraduate students from the humanities, social sciences, education, and arts. Students in these fields tend to value relational, affective, and guided learning experiences, which may amplify the effects of teacher participation and teamwork identified in the model. At the same time, these characteristics may partially explain the limited influence of peer interaction, as informal peer communication in virtual environments may be insufficient to generate strong affective engagement without structured guidance.

A notable finding is that peer interaction did not significantly predict affective engagement, contrasting with prior studies that emphasize the socio-emotional benefits of peer dynamics in gamified contexts [16], [29]. This discrepancy may be attributed to the distance-learning modality, where asynchronous communication and the absence of nonverbal cues constrain emotional bonding among students [30]. Under these conditions, gamification appears to strengthen individual engagement more effectively than affective peer connections.

More broadly, the results highlight the role of context in shaping gamification outcomes. In fully online environments, limited social presence and delayed interaction reduce spontaneous peer engagement while increasing the importance of structured activities and teacher-mediated support. Accordingly, gamification mechanisms in this study operated more strongly through motivation and instructor involvement than through informal peer exchange. From a practical standpoint, the results indicate that effective gamified course design should prioritize active teacher involvement, motivational feedback, and carefully structured teamwork. In virtual contexts where peer interaction is weaker, strategies such as guided discussion forums, optional synchronous sessions, and structured icebreaker activities may help strengthen social engagement. At the institutional level, gamification is more effective when implemented as a coordinated pedagogical strategy supported by faculty training and instructional design initiatives [12], [31].

Finally, the study is constrained by its cross-sectional design and its focus on a single Peruvian institution, which may limit the generalizability of the findings. Future research should consider longitudinal, experimental, or cross-cultural approaches to examine the stability of these engagement mechanisms across contexts.

3.4. Limitations and implications for future research

This research has several limitations that should be taken into account when interpreting the results. First, the use of a non-probabilistic sample drawn from a single private university limits the extent to which the findings can be generalized to other institutional and cultural settings. Future research is encouraged to incorporate larger and more heterogeneous samples in order to strengthen external validity. Additionally, the reliance on self-reported measures may introduce social desirability bias, which could influence how students perceive and report their motivation and engagement levels. Moreover, the cross-sectional nature of the study restricts the ability to draw causal conclusions. Consequently, future investigations should adopt longitudinal or experimental designs to better capture the development of engagement mechanisms over time. Finally, the lack of qualitative evidence reduces the depth of insight into the findings, as it prevents a more comprehensive understanding of students' subjective experiences in gamified learning environments. To address this limitation, future studies could employ mixed-methods approaches to obtain richer perspectives on student experiences and to further validate the engagement mechanisms identified in this study.

4. CONCLUSION

This study examined how gamification operates as a pedagogical strategy to enhance student engagement in distance higher education by modeling engagement as a multidimensional construct encompassing academic, cognitive, and affective components. The findings demonstrate that gamification influences engagement through differentiated pathways, rather than as a uniform mechanism, thereby clarifying how specific motivational, social, and instructional elements contribute to distinct engagement outcomes. These results provide a clearer conceptual explanation of how gamification mechanisms function within fully virtual higher education contexts.

In theoretical terms, the study advances current understanding by showing that motivation and teacher participation play central and complementary roles in sustaining engagement in virtual learning environments, while affective engagement acts as a key mechanism supporting deeper cognitive effort. At the same time, teamwork contributes positively when collaboration is structured, whereas informal peer interaction alone appears insufficient to foster affective engagement in fully online contexts. This integrated

perspective highlights the importance of simultaneously addressing cognitive, emotional, and academic dimensions when designing gamified learning experiences.

The results suggest that effective gamification in higher education should prioritize active instructor involvement, well-designed motivational elements, and carefully structured teamwork aligned with learning objectives. Institutions are encouraged to support gamification through faculty training and instructional design initiatives that move beyond isolated technological tools. Together, these strategies can help create engaging and meaningful learning experiences in distance higher education and strengthen student engagement across multiple dimensions.

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AUTHOR CONTRIBUTIONS STATEMENT

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declare no competing financial interests or personal relationships that could have influenced the research reported in this study.

INFORMED CONSENT

Written informed consent was secured from all adult participants prior to the study. Participation was voluntary, anonymous, and did not involve the collection of personally identifiable information.

DATA AVAILABILITY

Anonymized data supporting the study's results may be obtained from the corresponding author, [YT-Q], upon reasonable request.

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