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Gamification and student engagement in higher education: The moderating role of concentration

التعلم بالألعاب ومشاركة الطلاب في التعليم العالي: دور التركيز المُعتدل

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Abstract

Gamification in the teaching and education system is an innovative approach incorporating game elements into educational activities to enhance student engagement, motivation, and learning outcomes. Thus, this study investigates the relationship between attitude towards using gamification and student engagement (skill engagement and participation engagement) while exploring the moderating role of student concentration in this relationship. The 306 data were collected from the students in the Saudi public university to verify these proposed hypotheses. The findings indicate employing Structural Equation Modeling (SEM) via Partial Least Squares (PLS). The research framework evaluated the impact of attitude towards gamification on student engagement. Results revealed a significant positive relationship between attitude towards using gamification and student engagement, which is more noticeable when student concentration is high than when it is low. This study contributes to understanding the dynamics between gamification, student attitudes, concentration levels, and engagement within educational contexts.

Keywords: Gamification, Student Engagement (SE), Student Concentration, Learning and educational contexts.

الملخص

إن التعلم بالألعاب في نظام التعليم والتدريس هي نهج مبتكر يدمج عناصر اللعبة في الأنشطة التعليمية لتعزيز مشاركة الطلاب وتحفيزهم في نتائج التعلم. وبالتالي، تبحث هذه الدراسة في العلاقة بين الموقف تجاه استخدام التعلم بالألعاب ومشاركة الطلاب (مشاركة المهارات ومشاركة المشاركين) مع استكشاف الدور المعتدل لتركيز الطلاب في هذه العلاقة. تم جمع البيانات البالغ عددها 306 من الطلاب في الجامعات الحكومية السعودية للتحقق من هذه الفرضيات المقترحة. تشير النتائج الى استخدام نمذجة المعدلات الهيكلية عن طريق برنامج Partial Least Squares (PLS)
قام إطار البحث بتقييم تأثير الموقف تجاه التعلم بالألعاب على مشاركة الطلاب. كشفت النتائج عن وجود علاقة إيجابية كبيرة بين الموقف تجاه استخدام التعلم بالألعاب ومشاركة الطلاب، والتي تكون أكثر وضوحًا عندما يكون تركيز الطلاب مرتفعًا مقارنة بتركيزهم المنخفض. تساهم هذه الدراسة في فهم الديناميكيات بين التعلم بالألعاب ومواقف الطلاب ومستويات التركيز والمشاركة في السياقات التعليمية.

الكلمات المفتاحية: التعلم بالألعاب، مشاركة الطلاب، تركيز الطلاب، سياقات التعلم والتعليم

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Introduction

In the realm of modern education, fostering student engagement is paramount for effective learning outcomes (Aboramadan et al., 2023). Within this framework, the integration of gamification strategies offers a dynamic approach to captivate students' attention and enhance their participation (Huber et al., 2023). Skill Engagement (KE) and Participation Engagement (IE) serve as cornerstones in this endeavour. Skill Engagement focuses on developing and mastering specific skills essential for academic success and beyond (Schnitzler et al., 2021; Wong, & Liem, 2022). Through gamified activities, students are immersed in interactive experiences that challenge them to apply and refine their cognitive abilities, problem-solving skills, and creativity. Whether it's solving puzzles, completing quests, or participating in simulations, students actively engage in tasks designed to cultivate critical thinking and adaptability (Lin et al., 2024). The beauty of gamification lies in its ability to transform learning into a thrilling adventure, where students eagerly embrace challenges, overcome obstacles, and emerge as confident, skilful learners. On the other hand, Participation Engagement underscores the importance of active involvement and collaboration within the learning community. Gamification strategies encourage students to collaborate, communicate, and contribute collectively towards shared goals (Bouchrika et al., 2021). By incorporating elements like leaderboards, badges, and rewards, educators incentivize participation and foster a sense of achievement, fostering a positive learning environment where students feel valued and motivated to excel. Moreover, gamification facilitates peer interaction and teamwork, as students work together to strategize, problem-solve, and achieve common objectives. This collaborative spirit enhances academic learning also cultivates essential social and interpersonal skills crucial for success in the modern world (Taşkın, & Kılıç Çakmak, 2023).

Through the cooperative integration of Skill Engagement (KE) and Participation Engagement (PE) within gamified learning experiences, educators can cultivate an exciting classroom atmosphere where students are not just passive recipients of knowledge but active participants in their learning journey (Bilro et al., 2021). The gamified classroom becomes a hub of exploration, discovery, and innovation, where students are empowered to take ownership of their education and unleash their full potential. Furthermore, gamification surpasses traditional boundaries, catering to diverse learning styles and preferences, therefore ensuring inclusivity and accessibility for all students (Nkomo et al., 2021). By leveraging the intrinsic motivation and engagement inherent in gamified learning, educators can inspire a lifelong love for learning and equip students with the skills and mindset necessary for success in academia and beyond. As navigate the ever-evolving landscape of education, gamification stands out as a powerful tool for transforming teaching and learning, concrete the way for a brighter, more engaging future for students worldwide (Chen et al., 2024).

Concerning student concentration is an intricate aspect of the learning process that plays a critical role in academic success. Concentration is the ability to focus on a task that encompasses a complex interplay of attention, engagement, and cognitive processing (Deng, & Gao, 2023). In today's fast-paced and technology-driven world, students face a myriad of distractions that can impede their ability to concentrate effectively. From social media notifications to the constant buzz of electronic devices, preserving sustained focus can be a significant challenge (Pérez-Juárez et al., 2023). Nevertheless, fostering strong concentration skills is essential for deep learning and retention of information. Educators employ various strategies to promote concentration in the classroom, such as minimizing distractions, creating a conducive learning environment, and implementing mindfulness techniques. They may arrange the classroom layout to minimize visual and auditory distractions, establish clear routines, and set expectations for focused work periods (Flanigan, & Babchuk, 2022). Furthermore, educators can integrate technology in meaningful ways, leveraging it as a tool for learning rather than a distraction. By incorporating interactive educational apps or online platforms, educators can engage students while also promoting concentration and active participation (Ng et al., 2022). Moreover, incorporating active learning methods, such as hands-on activities, group discussions, and interactive exercises, can help capture students' interest and enhance their engagement, thereby bolstering their concentration levels. These activities stimulate multiple senses and encourage students to actively participate in their learning, fostering deeper engagement and concentration. Group discussions, for example, encourage students to actively listen to their peers, formulate responses, and contribute to the conversation, thereby promoting sustained attention and concentration. Moreover, collaborative learning experiences foster a sense of community and accountability, motivating students to stay focused and engaged (Chen et al., 2024).

Moreover, teaching students' self-regulation techniques, such as goal-setting, time management, and self-monitoring, empowers them to take control of their learning and overcome distractions effectively (Yin, & Luo, 2024). Educators can explicitly teach these skills through modelling, guided practice, and reflective exercises. By setting achievable goals, breaking tasks into manageable steps, and monitoring their progress, students learn to manage their time effectively and stay focused on their academic responsibilities (Martins et al., 2024). Additionally, mindfulness techniques, such as deep breathing exercises or mindfulness meditation, can help students develop greater awareness and control over their attention, enabling them to redirect their focus when distractions arise (Lai, & Hwang, 2023). Ultimately, by nurturing a supportive learning environment and equipping students with the tools and techniques to enhance their concentration, educators can empower them to reach their full potential and excel academically. By fostering a culture of focus, engagement, and self-regulation, educators lay the foundation for lifelong learning and success beyond the classroom (Janković et al., 2023).

Therefore, this study aims to examine the direct effect of the attitude towards using gamification on skill engagement and participation engagement which are regarded as crucial implications. Importantly, this study takes a sept further to make an important contribution by introducing the moderating role of student concentration while using gaming the teaching. Consequently, this study's contributions to theory and practice will help advance the education system within KSA.

Literature and Hypotheses Development

Attitude of Using Gamification and Students' Engagement

Various research has yielded different perspectives on student participation. Some scholars, including Mohd et al. (2016) and Marx et al. (2016), define student engagement as activities students undertake in their quest for knowledge, whether physically or mentally. According to Hu et al. (2016), it also encompasses the dedication shown when students utilize online learning platforms, where resources are individually accessible (Pardim et al., 2023). These studies also examine the factors influencing student participation. Mohd et al. (2016) and Hu et al. (2016) identify three components of student engagement: cognitive, behavioral, and emotional. However, further research by Handelsman et al. (2005) and Marx et al. (2016) categorizes student engagement into four groups: skill engagement (related to student abilities), emotional engagement (linked to student sentiments), participation (reflecting students' activities in learning), and performance engagement (indicative of student assessment outcomes). Conversely, Marx et al. (2016) and Thongmak (2018) acknowledge an additional aspect, total commitment, which gauges students' overall impression of their involvement in a particular course completed at their institutions.

The literature, as highlighted by Mohd et al. (2016) and Marx et al. (2016), underscores several key factors shaping students' engagement, particularly the dynamic between student attitudes and teacher interactions. Marx et al. (2016) further emphasized that educators' expectations for student engagement can be met through reciprocal engagement efforts. Consequently, with the abundance of available technologies in education, traditional teaching methods such as the "chalk and talk" approach are gradually losing prominence (Ab Rahman et al., 2018). This teacher-centred approach is increasingly less favoured among modern educators. In recent years, gamification in education has emerged as a significant research area. For instance, Hanus and Fox (2015) found that learners participating in gamified learning experiences showed decreased motivation, which impacted their engagement with game-based learning. Hence, contemporary research suggests that attitudes towards gamification can influence participation and engagement with game-based learning (Ab Rahman et al., 2018; Davis et al., 2018; Uz Bilgin & Gul, 2020). As a result, researchers have developed hypotheses to explore these anticipated effects.

H-1: Students' attitude toward using gamification positively influences student engagement (i.e., skill engagement of gamification).
H-2: Students' attitude toward using gamification positively influences student engagement (i.e., participant engagement of gamification).

Augmenting Role of Students' Concentration

For a game to be enjoyable, it necessitates concentration, with players capable of focusing solely on the game. The more demanding a task within the game, the more enticing it becomes. When a player's essential skills are required to tackle obstacles within the game, their concentration becomes fully absorbed by the

activity, leaving no excess capacity to address other matters (Csikszentmihalyi, 1990). Consequently, games should swiftly capture the player's interest and maintain it throughout, whether for 10 seconds, 10 minutes, 10 hours, or even 100 hours (Lazzaro & Keeker, 2004; Pitoyo, 2019). Games achieve this by offering compelling elements that draw players into immersive environments (Johnson & Wiles, 2003; Alabbasi, 2017; Yang et al., 2023). It is crucial to balance the workload in games, ensuring it remains challenging yet manageable within the player's perceptual, cognitive, and memory limitations (Lazzaro & Keeker, 2004).

Moreover, it's essential to avoid assigning tasks to participants who don't feel essential (Tikhonov et al., 2024). Ultimately, games, non-game-related interactions (e.g., setting choices), and game interfaces may need to be limited to optimize the screen space dedicated to game action (Johnson & Wiles, 2003; Ab Rahman et al., 2019). This study underscores the significance of concentration while using the game, positing that it leads students to engage more with it. Thus, drawing from the aforementioned theories and empirical evidence, the components are deemed significantly related to the attitude toward using gamification, and this attitude, in turn, affects students' engagement with the gamification method (Lampropoulos et al., 2023). Importantly, this study suggests that students' concentration may play a critical role in influencing the association between the attitude toward using gamification and its engagement. Consequently, the study proposes the following hypotheses:

H-3a: Students' concentration moderates the relationship between students' attitude toward using gamification and their engagement (i.e., skill engagement of gamification), such that the relationship will be stronger for those with high concentration than those with low.
H-3b: Students' concentration moderates the relationship between students' attitude toward using gamification and their engagement (i.e., participant engagement of gamification), such that the relationship will be stronger for those with high concentration than those with low.

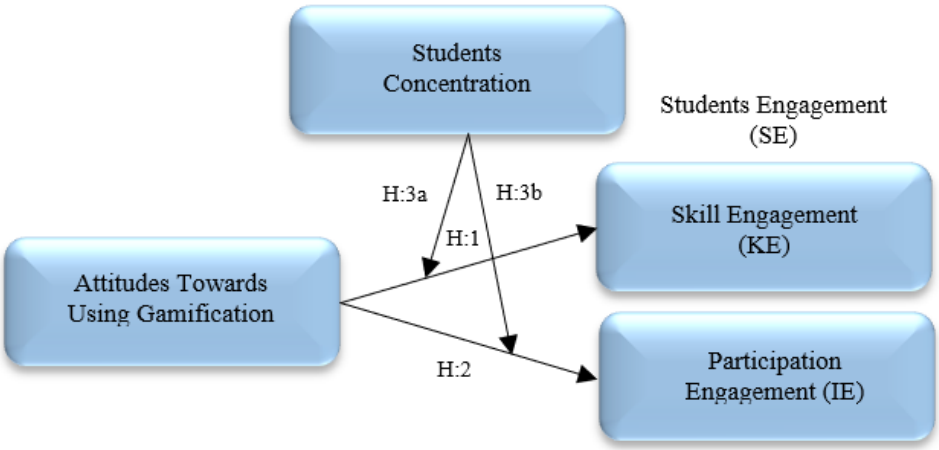

Figure 1. Research Model.

Method

Sample and Procedures

This study employs a quantitative research design to assess gamification's impact on student engagement in Saudi public universities. A convenience sampling method was chosen due to practical difficulties in accessing a complete target population list (Hulland et al., 2018). This approach enabled the researchers to concentrate on a readily accessible subset of students relevant to the study's objectives.

Before the primary data collection, the study employed a pilot test to ensure the reliability and validity of the measurement instruments. This pilot testing phase involved a smaller sample 54 of students similar to the target population, allowing us to refine the questionnaire and assess the clarity of the questions. The pilot test also provided an opportunity to evaluate the internal consistency of the survey items, using statistical methods such as Cronbach's alpha to measure reliability. Moreover, the measurement instruments used in the study were either adapted from previously validated scales or underwent rigorous validation

procedures, ensuring their appropriateness for the educational context. This process helped to enhance the accuracy and relevance of the data collected, ultimately contributing to the robustness of the study's findings (Memon et al., 2017).

The sample size of 306 participants was carefully considered and justified based on the dual need to achieve sufficient statistical power and to manage the logistical constraints inherent in reaching and surveying a large student population. This sample size was selected to balance the need for robust data with the practical limitations of conducting research within a specific educational setting. The size also aligns with typical standards in academic research, ensuring that the study's findings are statistically significant and reliable.

The study's data collection process was meticulously planned and executed in two distinct phases to provide a comprehensive evaluation of the participants' experiences with gamification. The first phase involved an introduction to gamification technology at the beginning of the semester, ensuring that students were familiar with the tools and concepts being studied. This phase included integrating gamification elements into the curriculum, primarily through formative assessments conducted using popular online platforms such as Kahoot and Quizizz. These platforms were chosen for their widespread recognition and effectiveness in enhancing student engagement through interactive and competitive learning activities. Using these platforms was integral to the research, as it allowed for the practical application of gamification techniques in a real-world educational context. The second phase of data collection took place at the end of the semester, where a detailed questionnaire was administered to capture the students' attitudes toward gamification, their levels of engagement, and their interactions with the gamification methods employed throughout the course. This two-phase approach ensured that the data collected reflected the students' immediate reactions to gamification and their sustained engagement over an entire semester. By structuring the research in this manner, the study provided a more holistic understanding of the impact of gamification on student engagement, taking into account both the initial novelty of the approach and its long-term effects on learning behavior and outcomes.

Therefore, the research approach and techniques employed in this study were designed to systematically investigate the effectiveness of gamification in enhancing student engagement in higher education. The study offers a robust framework for understanding the dynamics of gamification in educational settings through the careful selection of sampling methods, phased data collection, and the use of validated online platforms for gamification. The thoughtful design and execution of this research provide valuable insights into the immediate effects of gamification but also lay the groundwork for future studies that can build on these findings to explore the broader implications of gamification in diverse educational contexts.

Research Instrument

The questionnaires utilized in this analysis were adapted from established instruments and administered to undergraduate students enrolled in Saudi public universities. One set of questionnaires was provided to the target population, focusing on their attitudes toward using gamification and their level of concentration. The questionnaires aimed to gauge students' engagement with and interaction with gamification, with the content assessed through students' self-reports. Specifically, a standard questionnaire instrument was employed to collect all necessary information from the selected respondents. Each construct was measured using multi-item scales, and the response format utilized a 5-Likert Scale ranging from 1=Strongly Disagree to 5=Strongly Agree.

Regarding attitudes towards using gamification, 3-items are adapted from previous studies to measure users' technology acceptance (Davis, 1989; Fathema et al., 2015). A sample item is "I think using an online gamification system is a good idea". For the student concentration was measured with 4-items which were initially developed by Csikszentmihalyi (1990) and used by several studies (e.g., Hamari & Koivisto 2014).

Therefore, these items were slightly modified to clarify the context of the statements to ensure students understood the items thoroughly. A sample item is "games help me to quickly grab the attention and maintain their focus throughout the game". The students' engagement was measured students' engagement using the construct defined by Handelsman et al. (2005), which is skill engagement (3 items) and participation/interaction engagement (4 items). Then, these items were combined as another factor, student engagement (total of 7 items) (see Ab Rahman et al., 2018). The sample items are "Online gamification system encourages me to take good notes in the classroom" and "Online gamification system contributes to me having fun in the classroom".

Data Analysis and Results

This study utilized Structural Equation Modeling (SEM) through Partial Least Squares (PLS) via Smart PLS 4 software for data analysis. This approach is ideal for complex causal models and does not impose strict distributional assumptions. The PLS technique was selected for its robustness and capability to manage intricate relationships within the research model.

The analysis employed a two-stage approach for rigorous evaluation. First, the measurement model was assessed to confirm the validity and reliability of the study's scales, ensuring the credibility of the constructs. The second stage tested the structural model to examine the hypothesized relationships between variables. PLS analysis utilized a bootstrapping technique with 5,000 subsamples, as recommended by Hair et al. (2017, 2019), to determine the statistical significance of the path coefficients. This method provided bootstrap t-statistics, allowing for a more precise evaluation of the model relationships, thereby enhancing the study's results' robustness, overall reliability, and validity.

Minimization Common Method Bias

The potential issue of standard method bias (CMB) arising from using a single questionnaire to collect data on both independent and dependent variables was carefully addressed in this study. To mitigate this concern, rigorous attention and significant efforts were devoted to minimizing CMB, employing procedures and statistical techniques in a two-pronged approach, as suggested by Podsakoff et al. (2003; 2012). Firstly, a variety of measurement scales were incorporated into the research instruments to assess process components. Participants were explicitly informed that there were no correct or incorrect answers, encouraging unbiased responses. Importantly, data collection occurred in two stages: the initial phase involved introducing gamification technology at the beginning of the semester, followed by lectures and formative assessments using online gamification platforms (e.g., Kahoot and Quizizz) throughout the semester. Subsequently, phase 2 commenced at the end of the semester, with students completing a questionnaire to evaluate their attitude, engagement, and interaction with the utilized gamification. This comprehensive approach aimed to minimize potential biases and enhance the validity of the study's findings.

Second, in the statistical techniques, the approach of the Harman single-factor was employed. Thus, by employing exploratory factor analysis, Harman's single-factor analysis seeks to ascertain whether a single individual accounts for the preponderance of the covariance among all the items in this investigation. This test exposed no principal component since the variation of the initial element only contributed to 23% of the total variance, which was significantly less than 50%, and five variables with eigenvalues higher than one were found, contributing to 68% of the entire variability. The CMB is not a problem in this experiment (Podsakoff et al., 2003). Furthermore, we took it further and performed a complete collinearity study using full collinearity based on variance inflation factors (VIFs) (Kock, 2015). Kock and Lynn (2012), who established a method to measure both vertical and lateral collinearity, suggested the approach used. They suggest that when VIF values are more significant than 3.3, it is a sign of collinearity. As shown in Table 1, the maximum VIF was 2.114. Thus, these tests suggest that common method bias is not a significant concern in this study.

Table 1.
Common Method Variance Assessment Via Full Collinearity Estimate Criteria

Components	Attitude Towards Using Gamification	Students' Concentration	Skill Engagement	Participation Engagement
VIF	2.101	1.258	1.631	2.114

Note (s): VIF = Variance Inflation Factor

Construct Validity and Reliability

To develop the measurement model, we conducted assessments for item reliability, internal consistency reliability, convergent validity, and discriminant validity. Results indicated no significant issues regarding item reliability, with most items surpassing the recommended threshold of 0.707 (Hair et al., 2017), as illustrated in Table 2. Cronbach's Alpha and Composite Reliability (CR) were utilized to evaluate the internal consistency of constructs, yielding values ranging from 0.701 to 0.859 and 0.705 to 0.861,

respectively, surpassing the 0.70 cutoff (Hair et al., 2017). Convergent validity was assessed through the calculation of average variance extracted (AVE), with values ranging from 0.594 to 0.676, exceeding the required threshold of 0.5 (Hair et al., 2017). These findings are summarized in Table 2.

Table 2.
Measurement Model, Item Loadings, Construct Reliability and Convergent Validity

First-Order Constructs	Second-Order Constructs	Items	Factor Loading (> 0.5)	Cronbach's alpha (> 0.7)	Composite Reliability (rho_a) (> 0.7)	Average Variance Extracted (AVE) (>0.5)
Attitude Towards Using Gamification		ATUG-1	.810	.709	.723	.633
		ATUG-2	.860			
		ATUG-3	.845			
Students' Concentration		SC-1	.877	.825	.840	.654
		SC-2	.787			
		SC-3	.868			
		SC-4	.852			
Skill Engagement		SKE-1	.828	.701	.705	.626
		SKE-2	.837			
		SKE-3	.801			
Participation Engagement		PRE-1	.791	.859	.861	.543
		PRE-2	.713			
		PRE-3	.782			
		PRE-4	.807			
	Students' Engagement	Skill Engagement	.745	.821	.823	.551
		Participation Engagement	.890			

Regarding discriminant validity, Fornell-Larcker's method revealed no issues; the Average Variance Extracted (AVE) for each construct exceeded the variance shared with other latent variables, as displayed in Table 3 (Hair et al., 2017). Additionally, Henseler et al. (2015) proposed the Heterotrait-Monotrait Ratio (HTMT) of correlations based on the Multitrait-Multimethod Matrix as an alternative, more precise approach to Fornell-Larcker's technique. Table 4 illustrates that all HTMT values are below 0.90, indicating discriminant validity for each pair of variables. Moreover, as the 95% confidence intervals exclude 1, all HTMT values significantly differ from 1, confirming discriminant validity between each pair of variables (Henseler et al., 2015).

Table 3.
Measurement Model, Discriminant Validity via Fornell and Larcker Criterion

Constructs	1	2	3
1. Attitude towards Using Gamification	***0.796***		
2. Students' Concentration	0.447	**0.639**	0.379
3. Students' Engagement	0.586	0.520	**0.561**

Note (s): Diagonals represent the square root of the average variance extracted while the other entries represent the correlations.

Table 4.
Measurement Model, Discriminant Validity via (HTMT Criterion)

Constructs	1	2	3
1. Attitude towards Using Gamification			
6. Students' Concentration	0.579		0.434
7. Students' Engagement	0.750	0.615	

Hypotheses Testing

Table 5 presents the results of the direct effect hypotheses, specifically focusing on hypotheses 1 and 2. Hypothesis 1 examines the direct relationship between attitude towards using gamification and skill engagement the analysis reveals a statistically significant positive with H1 being accepted ($\beta = 0.154$, $t = 3.412$, $p < 0.000$). Similarly, H2, which explores the relationship between attitudes towards using gamification and participation engagement, also shows significance ($\beta = 0.157$, $t = 3.545$, $p < 0.000$). All relevant values are displayed in Table 5.

In regards to the interaction test (moderation), which indicated the attitude towards using gamification x students' concentration -> students' skill engagement ($\beta = 0.231$, $t = 2.204$, $p < 0.001$). In regards to the second interaction of attitude towards using gamification x students' concentration -> students' participation engagement ($\beta = 0.242$, $t = 4.672$, $p < 0.000$). Therefore, the relationship between attitude towards using gamification and students' engagement (i.e., skill engagement and participation engagement) is more robust when students' concentration is higher than low (see Table 5).

Table 5.
Hypotheses Test

Hypothesis	Direct Effect	Original sample	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Decision
H-1	Attitude towards Using Gamification-> Skill Engagement	0.154	0.045	3.412	0.000	Supported
H-2	Attitude towards Using Gamification -> Participation Engagement	0.157	0.044	3.545	0.000	Supported
	Interaction Effect (Moderation)					
H-3a	Attitude towards Using Gamification **x** Students' Concentration -> Students' Skill Engagement	0.231	0.036	2.204	0.001	Supported
H-3b	Attitude towards Using Gamification **x** Students' Concentration -> Students' Participation Engagement	0.242	0.052	4.672	0.000	Supported

The interpretation of the interaction term, following Dawson's (2014) recommendations, was conducted. Accordingly, after plotting the regression of high versus low students' concentration, it was observed that a positive relationship between attitude towards using gamification and students' engagement (i.e., skill engagement and participation engagement), becomes more pronounced when students' concentration is high compared to when it is low (Figure 2 and 3). This observation provides apparent support for Hypothesis 3a and 3b.

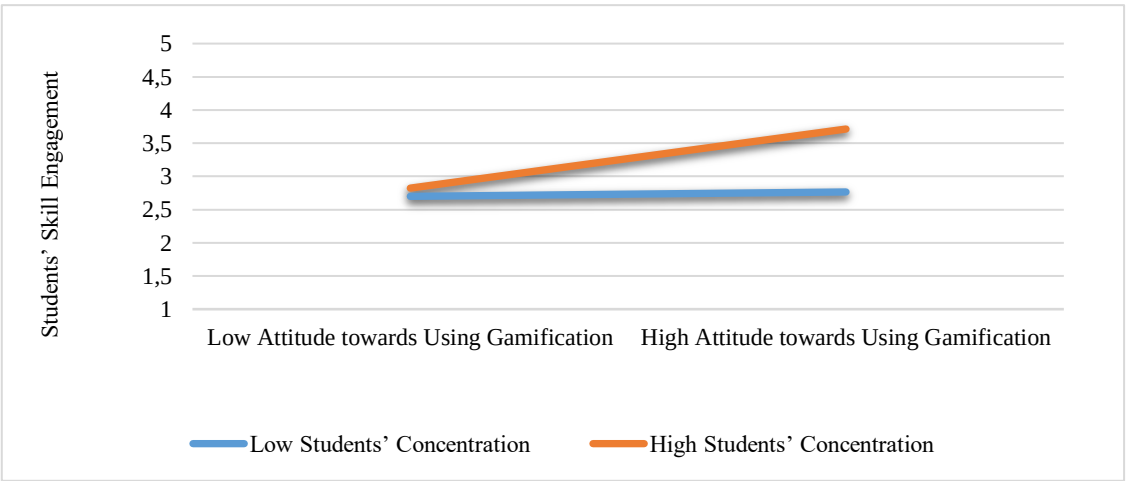

Figure 2. Graphing plot of interaction between attitude towards using gamification **x** students' concentration towards Students' Skill Engagement.

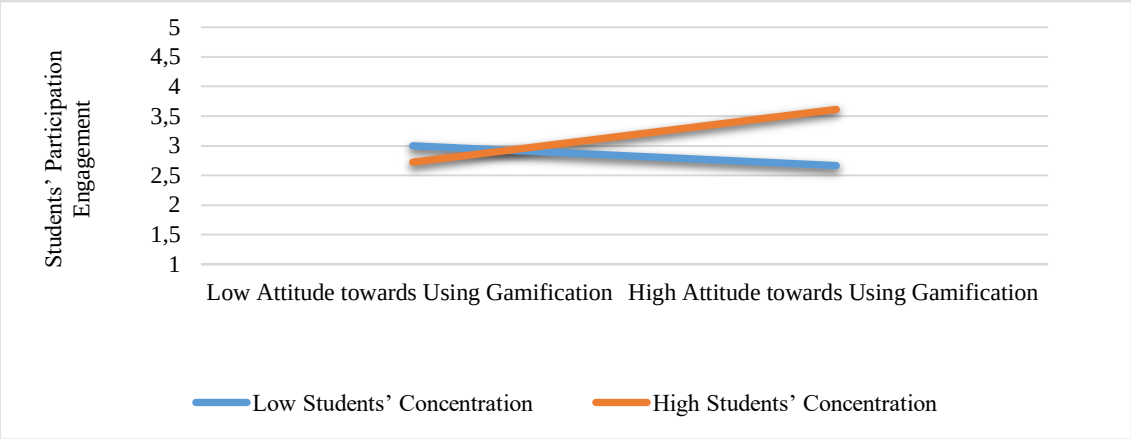

Figure 3. Graphing plot of interaction between attitude towards using gamification **x** students' concentration towards Students' Participation Engagement.

Thus, Figure 2 illustrates the relationship between attitudes towards gamification and student skill engagement, differentiated by high and low concentration levels. The steepness of the high concentration line indicates that as students' positive attitudes towards gamification increase, their skill engagement rises more significantly compared to when concentration is low, as shown by the flatter slope of the low concentration line. This suggests that changes in attitudes towards gamification have a diminished effect on skill engagement when concentration is low.

In regards to Figure 3 represents a similar interaction but focuses on another type of engagement, such as participation engagement, the interpretation of the slopes would follow a similar pattern. A steeper slope at high concentration levels than at low levels would confirm that gamification's effect on participation engagement is more pronounced when students are highly focused.

Significance of concentration levels, the difference between high and low concentration levels is significant in understanding the effectiveness of gamification. When students' concentration is high, their engagement in skills or participation increases significantly with positive attitudes towards gamification, as indicated by steeper slopes. In contrast, when concentration is low, the impact of gamification on engagement is less pronounced. This suggests that while gamification can enhance engagement, its effectiveness is contingent upon students being in a state of high concentration.

Moderation hypothesis H-3a posits that concentration moderates the relationship between attitude towards gamification and skill engagement, and Figure 2 shows a significant interaction effect with steeper slopes for high concentration, and this would support the hypothesis. The increased impact of gamification on skill engagement at high concentration levels confirms that concentration moderates this relationship. If H-3b suggests a similar moderating effect for participation engagement, and Figure 3 shows that the relationship between attitude towards gamification and participation engagement is more robust at high concentration levels, this would support the hypothesis. If the slopes are less steep or insignificant at low concentration levels, it further supports that concentration moderates the relationship.

Discussion and Implications

This study is significant in education as it explores the dynamics of gamification in teaching. It examines how attitudes toward gamification relate to student engagement, particularly skill, and participation engagement while considering the moderating effect of student concentration. Conducted among Saudi public university students, the research provides valuable insights into a diverse educational landscape, with all findings showing statistical significance. The results reveal a notable positive correlation between attitudes toward gamification and student engagement, especially at higher concentration levels. This study enhances our understanding of the relationship between gamification, student attitudes, concentration, and engagement, paving the way for more effective and tailored teaching methods to improve student learning experiences.

This study enhances our understanding of gamification in higher education by underscoring the critical role of student concentration as a moderating factor. While previous research, such as Nkomo et al. (2021), has

shown that gamification boosts student motivation and engagement, this study reveals that its effectiveness varies significantly based on students' ability to concentrate. This finding challenges the assumption that gamification alone enhances engagement, suggesting that its success depends on students' cognitive states. Additionally, by focusing on skill engagement and participation engagement, the study offers a more nuanced exploration of how different facets of student involvement are affected by gamified strategies, thereby expanding the research landscape.

Based on these findings, educators are encouraged to consider not only the incorporation of gamification into their teaching practices but also the creation of an environment conducive to sustained concentration. For instance, instructors could implement gamification techniques aligned with structured learning activities, such as using rewards and challenges that require critical thinking and sustained effort, thereby promoting deeper engagement. Moreover, educators might consider using short, focused, gamified tasks when students are most likely to be attentive, such as at the beginning of a class session, to capitalize on natural peaks in concentration (Lazzaro & Keeker, 2004). To further enhance concentration, educators could introduce techniques such as mindfulness exercises or brief breaks designed to refresh and refocus students, ensuring they are cognitively prepared to engage with gamified content fully. Tailoring gamification strategies to the unique needs of students, perhaps through personalized learning paths or adaptive learning technologies, can also help address varying levels of concentration among students, thus maximizing the potential benefits of gamification (Pitoyo, 2019).

Regarding, theoretical implications, this study holds significant theoretical implications and contributes substantially to the body of knowledge in education by investigating the relationship between attitudes toward gamification and student engagement. Significantly, while also considering the moderating role of student concentration, this research advances our understanding of the dynamics underlying gamified learning environments. This study enhances the body of knowledge by shedding light on the intricate interplay between gamification, student attitudes, concentration levels, and engagement within educational settings, offering valuable insights for educators and researchers seeking to optimize teaching practices and enhance student learning experiences.

For the practical aspects, thus, the practical implications of this study are far-reaching and hold substantial significance for policymakers and stakeholders in the education system in Saudi Arabia. By elucidating the relationship between attitudes towards gamification and student engagement, particularly in terms of skill engagement and participation engagement, while also examining the moderating effect of student concentration, this research offers actionable insights to enhance teaching methods and improve the overall education system. The findings provide policymakers with evidence-based guidance on the effectiveness of gamification in fostering student engagement and motivation. Policymakers can leverage these insights to inform the integration of gamification strategies into curriculum design and instructional practices, thereby promoting more interactive and dynamic learning experiences for students. Furthermore, the identification of the moderating role of student concentration underscores the importance of creating conducive learning environments that facilitate student focus and attention. Policymakers can use this knowledge to implement strategies aimed at optimizing student concentration levels, such as reducing distractions and promoting mindfulness techniques in classrooms. Ultimately, by embracing gamification and tailoring teaching methods to enhance student engagement and concentration, policymakers can work towards cultivating a more effective and impactful education system in Saudi Arabia, empowering students to achieve their full academic potential and succeed in an increasingly competitive global landscape.

Conclusion

This study strongly demonstrates that gamification effectively enhances student engagement in Saudi educational settings. Students with positive attitudes exhibit higher skill and participation levels, and this effect is intensified when their concentration is high, indicating that gamification fosters engagement more effectively during focused learning. The research highlights the critical role of student concentration as a moderating factor, suggesting that successful gamification strategies should enhance and maintain focus to maximize the advantages of gamified learning.

This study demonstrates a strong positive correlation between students' attitudes toward gamification and their engagement in educational activities. Students who view gamification favorably are more actively engaged in skill development and participation. This relationship is significantly pronounced when students maintain high concentration levels, suggesting that gamification is most effective in enhancing engagement

when the focus is intense. The findings reveal critical insights into the interplay between gamification, student attitudes, and concentration. The effectiveness of gamification largely hinges on students' concentration, underscoring the importance of integrating gamified elements while ensuring optimal focus to maximize benefits. This dual emphasis aids in optimizing gamified learning strategies.

Furthermore, the study contributes to educational discourse by showcasing effective gamification integration to enhance student engagement. It provides empirical evidence for designing educational interventions aligned with students' attitudes and cognitive states (Chen et al., 2024). Educators and policymakers can utilize these insights to develop gamification strategies that foster student interest and promote sustained engagement through improved concentration. Overall, this research deepens our understanding of gamification's connection to psychological factors like concentration and its impact on educational outcomes, offering practical implications for creating engaging and effective learning experiences (Schnitzler et al., 2021).

Limitations and Future Direction

This study offers valuable insights, but several limitations must be acknowledged, and future research directions need consideration. Using a convenience sample of 306 students from a single public university in Saudi Arabia may restrict the generalizability of the findings, especially in contexts with different educational systems, cultural norms, or levels of technological integration. Additionally, the unique characteristics of Saudi higher education may mean that the results do not apply directly to other educational settings. The reliance on self-reported data to measure attitudes, engagement, and concentration introduces potential biases, such as social desirability or inaccurate self-assessment, which could impact the outcomes.

Future research should expand the sample size and include multiple universities from diverse regions or countries to address these limitations to enhance generalizability. Longitudinal studies tracking changes in student engagement and concentration over time, especially related to sustained exposure to gamification, would provide deeper insights into its long-term effects. Experimental designs manipulating concentration levels through controlled interventions could offer more robust evidence of causality in the relationship between gamification and engagement. Additionally, exploring the impact of specific gamification elements (e.g., competition vs. collaboration, rewards vs. narrative) on various forms of engagement could help educators refine their approaches for greater effectiveness. Research could also examine the intersection of gamification with other pedagogical innovations, such as flipped classrooms or blended learning, to understand how these strategies might further improve student learning outcomes.

The study provides valuable insights into the relationship between attitudes toward gamification and student engagement. Yet, it primarily focused on this relationship, potentially overlooking other critical factors that could influence engagement levels. For instance, instructor characteristics, such as teaching style, experience, and rapport with students, along with the classroom environment—including the physical setup, social dynamics, and access to technological resources—are all variables that might significantly impact how students engage with gamified learning. Future research should incorporate these variables to gain a more nuanced and holistic understanding of the determinants of student engagement in gamified environments. By doing so, educators and researchers can better identify the interplay between these factors and how they collectively shape student outcomes in gamified settings.

Furthermore, while the study effectively explored the moderating role of student concentration, it did not consider other potential moderators that could influence the effectiveness of gamification. For example, individual differences in gaming experience could play a critical role in how students respond to gamified elements, with those more familiar with gaming potentially finding these elements more engaging or intuitive. Similarly, students' intrinsic motivation—whether logically inclined to find the material interesting or driven by external rewards—could significantly affect how they engage with gamified content. Future studies should investigate these and other potential moderators, such as personality traits or learning styles, to uncover additional insights into the conditions under which gamification is most effective. This would enable a more tailored approach to gamification, where strategies could be adapted to suit different student profiles, thereby maximizing their educational impact.

Furthermore, the study's reliance on self-reported measures for assessing attitudes, concentration levels, and engagement introduces the possibility of bias and measurement error, which could affect the reliability of the findings. Self-reporting often comes with the risk of social desirability bias, where respondents may

answer in a way, they believe is expected rather than reflect their true feelings or behaviors. Future research should consider utilizing objective measures or observational methods to mitigate these concerns. For example, tracking actual engagement through behavioral indicators, such as time spent on tasks, participation in class discussions, or performance on gamified activities, could provide a more accurate reflection of student engagement. Similarly, physiological measures of concentration, like eye-tracking or heart rate variability, could offer a more objective assessment of students' focus during gamified learning sessions. These methods would enhance the validity of the findings and provide a more robust foundation for understanding the dynamics of gamification in education.

Moreover, the study primarily examined the relationship between attitudes towards gamification and student engagement, neglecting other potential factors that may influence engagement levels, such as instructor characteristics or classroom environment. Future research could incorporate these variables to gain a more nuanced understanding of the determinants of student engagement in gamified learning environments. Furthermore, while the study explored the moderating role of student concentration, other potential moderators, such as individual differences in gaming experience or motivation, were not examined. Future studies could investigate these factors to uncover additional insights into the conditions under which gamification is most effective. Lastly, using self-reported measures for attitudes, concentration levels, and engagement may introduce bias and measurement error. Future research could utilize objective measures or observational methods to enhance the validity of findings. Addressing these limitations and exploring additional variables and moderators will contribute to a more comprehensive understanding of gamification dynamics in educational contexts and inform the development of more effective teaching practices.

Thus, addressing these limitations and expanding the scope of future research to include additional variables, potential moderators, and more objective measurement tools will significantly contribute to a more comprehensive understanding of gamification dynamics in educational contexts. This, in turn, can inform the development of more effective, evidence-based teaching practices that are better aligned with students' diverse needs and preferences. By integrating these considerations, educators can create more engaging, inclusive, and impactful learning experiences that harness the full potential of gamification to enhance student learning outcomes.

Bibliographic References

Ab Rahman, R. A., Ahmad, S., & Hashim, U. R. (2018). The effectiveness of gamification technique for higher education students' engagement in polytechnic Muadzam Shah Pahang, Malaysia. *International Journal of Educational Technology in Higher Education*, *15*(1), 1-16.

Ab Rahman, R., Ahmad, S., & Hashim, U. R. (2019). A study on gamification for higher education students' engagement towards education 4.0. In *Intelligent and Interactive Computing* (pp. 491-502). Singapore: Springer.

Aboramadan, M., Barbar, J., Alhabil, W., & Al Halbusi, H. (2023). Green servant leadership and green voice behavior in Qatari higher education: does climate for green initiative matter? International *Journal of Sustainability in Higher Education*, *25*(3), 539-555. https://doi.org/10.1108/ijshe-03-2023-0112

Alabbasi, D. (2017). Exploring graduate students' perspectives towards using gamification techniques in online learning. *Turkish Online Journal of Distance Education*, *18*(3), 180-196.

Alzate, L. A., & Gaitán Martínez, Y. M. (2024). Impacto de las TIC en la enseñanza y aprendizaje en estudiantes inclusivos del programa de Licenciatura en Informática. *Revista Científica Del Amazonas*, *7*(13), 20-29. https://doi.org/10.34069/RA/2024.13.03

Bilro, R. G., Loureiro, S. M. C., & Angelino, F. J. D. A. (2021). The role of creative communications and gamification in student engagement in higher education: A sentiment analysis approach. *Journal of Creative Communications*, *17*(1), 7-21.

Bouchrika, I., Harrati, N., Wanick, V., & Wills, G. (2021). Exploring the impact of gamification on student engagement and involvement with e-learning systems. *Interactive Learning Environments*, *29*(8), 1244-1257.

Chen, F., Li, S., Lin, L., & Huang, X. (2024). Identifying temporal changes in student engagement in social annotation during online collaborative reading. *Education and Information Technologies*, 1-24.

Csikszentmihalyi, M. (1990). *Flow: The psychology of Optimal Experience* (Vol. 1990). New York: Harper & Row.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, pp. 319-340.

Davis, K., Sridharan, H., Koepke, L., Singh, S., & Boiko, R. (2018). Learning and engagement in a gamified course: Investigating the effects of student characteristics. *Journal of Computer Assisted Learning*, *34*(5), 492-503.

Dawson, J. F. (2014). Moderation in management research: What, why, when, and how. Journal of Business and Psychology, 29(1), 1-19.

Deng, R., & Gao, Y. (2023). A review of eye tracking research on video-based learning. *Education and Information Technologies*, *28*(6), 7671-7702.

Fathema, N., Shannon, D., & Ross, M. (2015). Expanding the Technology Acceptance Model (TAM) to examine faculty use of Learning Management Systems (LMSs) in higher education institutions. *Journal of Online Learning & Teaching*, *11*(2).

Flanigan, A. E., & Babchuk, W. A. (2022). Digital distraction in the classroom: exploring instructor perceptions and reactions. *Teaching in Higher Education*, *27*(3), 352-370.

Hair, Jr, J. F., Sarstedt, M., Ringle, C. M., & Gudergan, S. P. (2017). *Advanced issues in partial Least Squares Structural Equation Modeling*. Sage Publications.

Hair, J. F., Sarstedt, M., & Ringle, C. M. (2019). Rethinking some of the rethinking of partial least squares. *European Journal of Marketing*, *53*(4), 566-584.

Hamari, J., & Koivisto, J. (2014). Measuring flow in gamification: Dispositional flow scale-2. *Computers in Human Behavior*, *40*, 133-143.

Handelsman, M. M., Briggs, W. L., Sullivan, N., & Towler, A. (2005). A measure of college student course engagement. *The Journal of Educational Research*, *98*(3), 184-192.

Hanus, M. D., & Fox, J. (2015). Assessing the effects of gamification in the classroom: A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance. *Computers & Education*, *80*, 152-161.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modelling. *Journal of the Academy of Marketing Science*, *43*(1), 115-135.

Hu, M., Li, H., Deng, W., & Guan, H. (2016). Student engagement: one of the necessary conditions for online learning. *In 2016 International Conference on Educational Innovation through Technology (EITT)* (pp. 122-126). IEEE.

Huber, S. E., Cortez, R., Kiili, K., Lindstedt, A., & Ninaus, M. (2023). Game elements enhance engagement and mitigate attrition in online learning tasks. *Computers in Human Behavior*, *149*, 107948.

Hulland, J., Baumgartner, H., & Smith, K. M. (2018). Marketing survey research best practices: evidence and recommendations from a review of JAMS articles. *Journal of the Academy of Marketing Science*, *46*(1), 92-108.

Janković, A., Maričić, M., & Cvjetićanin, S. (2023). Comparing science success of primary school students in the gamified learning environment via Kahoot and Quizizz. *Journal of Computers in Education*, *11*(2), 471-494.

Johnson, D., & Wiles, J. (2003). Effective affective user interface design in games. *Ergonomics*, *46*(13-14), 1332-1345.

Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of e-Collaboration (ijec)*, *11*(4), 1-10.

Kock, N., & Lynn, G. (2012). Lateral collinearity and misleading results in variance-based SEM: An illustration and recommendations. *Journal of the Association for Information Systems*, *13*(7). http://doi.org/10.17705/1jais.00302

Lai, C. L., & Hwang, G. J. (2023). Strategies for enhancing self-regulation in e-learning: a review of selected journal publications from 2010 to 2020. *Interactive learning environments*, *31*(6), 3757-3779.

Lampropoulos, G., Keramopoulos, E., Diamantaras, K., & Evangelidis, G. (2023). Integrating Augmented Reality, Gamification, and Serious Games in Computer Science Education. *Education Sciences*, *13*(6), 618.

Lazzaro, N., & Keeker, K. (2004). What is my method? A game show on games. In *CHI'04 Extended Abstracts on Human Factors in Computing Systems* (pp. 1093-1094).

Lin, L., Dong, Y., Chen, X., Shadiev, R., Ma, Y., & Zhang, H. (2024). Exploring the impact of design thinking in information technology education: An empirical investigation. *Thinking Skills and Creativity*, *51*, 101450.

Martins, J., Rosário, P., Cunha, J., Núñez, J. C., Vallejo, G., & Moreira, T. (2024). How to help students in their transition to middle school? Effectiveness of a school-based group mentoring program promoting students' engagement, self-regulation, and goal setting. *Contemporary Educational Psychology*, *76*, 102230.

Marx, A. A., Simonsen, J. C., & Kitchel, T. (2016). Undergraduate Student Course Engagement and the Influence of Student, Contextual, and Teacher Variables. *Journal of Agricultural Education*, *57*(1), 212-228.

Memon, M. A., Ting, H., Ramayah, T., Chuah, F., & Cheah, J. H. (2017). A review of the methodological misconceptions and guidelines related to applying structural equation modelling: A Malaysian scenario. *Journal of Applied Structural Equation Modeling*, *1*(1), 1-13.

Mohd, I. H., Hussein, N., Aluwi, A. H., & Omar, M. K. (2016). Enhancing student engagement through blended learning satisfaction and lecturer support. In *2016 IEEE 8th International Conference on Engineering Education (ICEED)* (pp. 175-180). IEEE.

Ng, D. T., Ng, E. H., & Chu, S. K. (2022). Engaging students in creative music making with musical instrument application in an online flipped classroom. *Education and information Technologies*, *27*(1), 45-64.

Nkomo, L. M., Daniel, B. K., & Butson, R. J. (2021). Synthesis of student engagement with digital technologies: a systematic review of the literature. *International Journal of Educational Technology in Higher Education*, *18*, 1-26.

Pardim, V. I., Contreras Pinochet, L. H., Viana, A. B. N., & Souza, C. A. D. (2023). Where is the student who was here? Gamification as a strategy to engage students. *The International Journal of Information and Learning Technology*, *40*(2), 177-192.

Pérez-Juárez, M. Á., González-Ortega, D., & Aguiar-Pérez, J. M. (2023). Digital Distractions from the Point of View of Higher Education Students. *Sustainability*, *15*(7), 6044.

Pitoyo, M. D. (2019). Gamification-based assessment: A test anxiety reduction through game elements in the Quizizz platform. *IJER (Indonesian Journal of Educational Research)*, *4*(1), 22-32.

Podsakoff, P. M., MacKenzie, S. B., & Podsakoff, N. P. (2012). Sources of method bias in social science research and recommendations on how to control it. *Annual review of psychology*, *63*(1), 539-569.

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioural research: a critical review of the literature and recommended remedies. *Journal of applied psychology*, *88*(5), 879.

Schnitzler, K., Holzberger, D., & Seidel, T. (2021). All better than being disengaged: Student engagement patterns and their relations to academic self-concept and achievement. *European Journal of Psychology of Education*, *36(3)*, 627-652.

Taşkın, N., & Kılıç Çakmak, E. (2023). Effects of gamification on behavioral and cognitive engagement of students in the online learning environment. *International Journal of Human–Computer Interaction*, *39*(17), 3334-3345.

Thongmak, M. (2018). Raising students' cognitive engagement intention in a preliminary course using gamification. In *International Conference on Research and Practical Issues of Enterprise Information Systems* (pp. 81-95). Springer, Cham.

Tikhonov, P., Levchuk, A., Trufanov, A., Efimtsev, A., & Zubkov, M. (2024). Addiction-like alterations of brain activity in recreational video gamers detected via the cue-reactivity fMRI experiment. *Computers in Human Behavior*, *152*, 108052.

Uz Bilgin, C., & Gul, A. (2020). Investigating the effectiveness of gamification on group cohesion, attitude, and academic achievement in collaborative learning environments. *TechTrends*, *64*(1), 124-136.

Wong, Z. Y., & Liem, G. A. D. (2022). Student engagement: Current state of the construct, conceptual refinement, and future research directions. *Educational Psychology Review*, *34*(1), 107-138.

Yang, F. C. O., Lai, H. M., & Wang, Y. W. (2023). Effect of augmented reality-based virtual educational robotics on programming students' enjoyment of learning, computational thinking skills, and academic achievement. *Computers & Education*, *195*, 104721.

Yin, D., & Luo, L. (2024). The influence of perceived teacher support on online English learning engagement among Chinese university students: a cross-sectional study on the mediating effects of self-regulation. *Frontiers in Psychology*, *15*, 1246958.