Levelling up Learning: Exploring Gamification Impact on Saudi Undergraduates' Student Engagement in Higher Education

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***Abstract*—Gamification and gamified systems have gained increasing attention in recent studies. Gamification can involve a range of elements, such as incorporating game-like features into software design and is not always limited to software products. This research examines the direct impact of the Unified Theory of Acceptance and Use of Technology (UTAUT) model's components (performance expectancy, effort expectancy, social influence, and facilitating conditions) on attitudes toward using gamification and student engagement (specifically skill and participant engagement). The study also explores the moderating effect of student concentration on the relationship between attitudes toward gamification and student engagement. Data were collected from 306 undergraduate students attending public universities in Saudi Arabia. The findings demonstrate that all UTAUT components significantly influence attitudes toward gamification, and student concentration positively moderates the link between attitudes and engagement. These results contribute important insights for both theoretical and practical applications.**

***Keywords*—gamification, Unified Theory of Acceptance and Use of Technology (UTAUT), students concentration, Students Engagement (SE), higher education, Structural Equation Modelling (SEM)**

I. Introduction

Gamification has emerged as a popular educational strategy [1, 2]. Its incorporation into games and teaching materials has grown due to its potential to enhance learning [3, 4]. Since its inception in 2008, gamification has been increasingly integrated into curricula [5]. Defined as the application of game design elements to non-game contexts [6], gamification is believed to boost learner motivation and performance [7, 8].

Students today prefer dynamic learning environments, which gamification can provide [9, 10]. Many educators view game-based learning as a superior alternative to traditional textbooks [11, 12]. Gamification is rapidly gaining traction in training and development [13]. However, while research on gamification design and development is extensive [14–16], how students interact with gamified experiences remains an area that requires further exploration [17–19].

Various theoretical models have been employed to examine attitudes toward gamification, including Theory of Reasoned Action (TRA), Theory of Planned Behavior (TPB), Innovation Diffusion Theory (IDT), and Social Cognitive Theory (SCT) [20, 21]. The Unified Theory of Acceptance and Use of Technology (UTAUT) [22] offers a comprehensive framework for predicting technology acceptance by incorporating key determinants such as performance expectancy, effort expectancy, social influence, facilitating conditions, behavioral intention, and use behavior. While applicable across various technologies, UTAUT is particularly relevant for understanding attitudes toward gamification.

Despite significant advancements in gamification research, a critical gap remains in understanding how cognitive factors, particularly student concentration, interact with gamification to influence engagement. Existing studies have primarily focused on gamification's impact on motivation and performance but have not sufficiently examined how concentration moderates engagement within gamified environments [23, 24]. Moreover, few studies have applied the UTAUT model to explore gamification in non-Western educational contexts, particularly within Saudi Arabia, where cultural factors may alter the dynamics of technology acceptance and engagement. Therefore, this study aims to fill this gap by examining how UTAUT constructs affect attitudes and student engagement with gamification by analyzing the moderating role of student concentration in this relationship.

Building upon previous research that explored the relationship between UTAUT constructs and attitudes toward gamification [25, 26], this study delves deeper by investigating the impact of these constructs on both attitudes and student engagement, including skill and participant engagement. Furthermore, the study examines how students' concentration moderates the relationship between attitude and engagement. By analyzing data from Saudi undergraduate students, this research aims to contribute to the understanding of game-based learning effectiveness and inform instructional design practices.

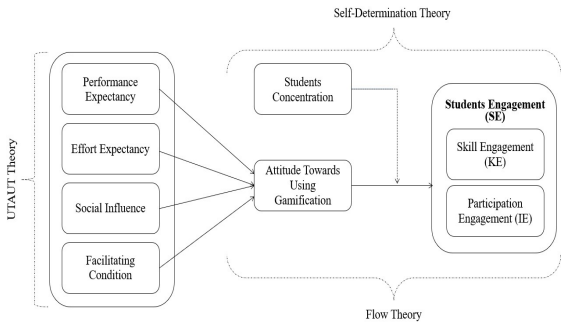

Fig. 1. Proposed research model.

In essence, this study seeks to understand the factors influencing student engagement with gamification by

examining the direct effects of UTAUT constructs on attitudes and engagement, as well as the moderating role of student concentration (see Fig. 1).

II. Theory and Hypotheses Development

The Theory of Reasoned Action (TRA) [25] and the Theory of Planned Behavior (TPB) [26] are widely recognized frameworks that have been extensively applied in research to explore users' attitudes, motivations, and behaviors toward technology adoption. TRA primarily focuses on attitudes and subjective norms, while TPB extends this by including perceived behavioral control, offering a more holistic view of factors influencing behavior. These models have been instrumental in studying technology acceptance in various contexts, yet they remain somewhat limited in addressing complex, real-world scenarios where multiple factors simultaneously influence behavior.

Given these limitations, the UTAUT was selected for this study. UTAUT integrates key elements from TRA, TPB, and other technology acceptance models, providing a more comprehensive framework for understanding the factors that influence technology adoption. This includes performance expectancy, effort expectancy, social influence, and facilitating conditions, which have been found to significantly affect user behavior in different settings. UTAUT has been applied in various longitudinal studies across diverse industries, demonstrating its robustness in predicting user intentions and behaviors in both voluntary and mandatory environments [3]. Therefore, it offers a stronger foundation for investigating the factors influencing students' engagement with gamification in the context of Saudi higher education. These factors are summarized as follows:

A. Performance Expectancy and Attitude toward Using Gamification

Performance expectancy, as defined by the UTAUT, reflects the belief that using a system enhances job performance [3]. In the context of gamification, it is the belief that using gamified tools improves task efficiency and learning outcomes [27–29]. Previous research has consistently shown that performance expectancy is a significant predictor of attitudes toward technology adoption, including gamification [30–32].

H1: Higher educational students' performance expectancy (PE) positively influences their attitude toward using gamification.

B. Effort Expectancy and Attitude toward Using Gamification

Effort expectancy, as defined by the UTAUT, refers to the perceived ease of use of a system [3]. Previous research has shown that effort expectancy is another important predictor of technology adoption, as users are more likely to adopt and use technologies that they perceive as easy to use [29, 33, 34].

H2: Higher educational students' effort expectancy (EE) positively influences their attitude toward using gamification.

C. Social Influence and Attitude Toward Using Gamification

Social influence, as defined by the UTAUT, reflects the perceived pressure from others to use a new system [3]. Previous research has shown that social influence can be a significant predictor of technology adoption, particularly in mandatory settings [18, 35, 36].

H3: Higher educational students' Social Influence (SI) positively influences their attitude toward using gamification.

D. Facilitating Conditions and Attitude toward Using Gamification

Facilitating conditions, as defined by the UTAUT, refer to the availability of resources and support for using a system [3]. Previous research has shown that facilitating conditions can be a significant predictor of technology adoption, as users are more likely to adopt and use technologies when they have the necessary resources and support [29, 37, 38].

H4: Higher educational students' Facilitating Conditions (FC) positively influence their attitude toward using gamification.

E. Attitude toward Using Gamification and Students' Engagement

Previous research has shown that attitudes toward technology can influence user engagement [39–41]. In the context of gamification, it is hypothesized that students' attitudes toward using gamification will positively influence their engagement, as students who have positive attitudes toward gamification are more likely to be motivated to use it and participate in gamified activities.

H5: Students' attitude toward using gamification positively influences their engagement (i.e., skill engagement and participant engagement of gamification).

F. Moderating Role of Students' Concentration

Concentration, as defined by Csikszentmihalyi (1990), is a state of complete absorption in an activity. Previous research has shown that concentration can be a moderator of the relationship between attitudes and engagement, such that the relationship may be stronger for individuals who are able to concentrate and focus on the task at hand [42, 43].

H6: Students' concentration moderates the relationship between students' attitude toward using gamification and their engagement (i.e., skill engagement and participant engagement of gamification), such that the relationship will be stronger for those with high concentration than those with low concentration.

III. Methods

A. Sample and Procedures

This study focused on undergraduate students enrolled in Saudi public universities. Participants were selected based on their enrollment in higher education and willingness to engage with educational games provided by instructors. Due to the challenges of obtaining a complete population list of undergraduate students enrolled in Saudi public universities, convenience sampling was employed [44]. While convenience sampling can limit the generalizability of findings, several factors justify its use in this context:

Accessibility: Convenience sampling allowed for efficient recruitment of participants who were readily available and willing to participate.

Feasibility: Given the large number of undergraduate

students in Saudi public universities, obtaining a complete population list would have been time-consuming and resource-intensive.

Relevance: The study focused on understanding the attitudes and engagement of undergraduate students with gamification, making it relevant to the target population.

To mitigate the potential limitations of convenience sampling, the study ensured a diverse sample by including participants from various universities, academic disciplines, and demographic backgrounds. Additionally, the findings can be supported by existing literature on gamification and student engagement, which can provide further validation and generalizability.

This study utilized convenience sampling to recruit undergraduate students from Saudi public universities. At the beginning of the semester, participants were introduced to gamification technology through an orientation session that explained its purpose and demonstrated how game-based learning tools would be integrated into their coursework. Platforms such as Kahoot and Quizizz were used, and students were shown how to navigate and interact with these tools. Throughout the semester, students actively participated in gamified activities, which included quizzes, interactive sessions, and learning modules designed to enhance engagement and reinforce course material. These gamified elements were embedded in the curriculum, allowing students to gain hands-on experience and become fully immersed in the gamified learning environment. Upon completing the semester, students were asked to fill out a comprehensive questionnaire to evaluate their attitudes toward gamification, their level of engagement, and their overall interaction with the gamified activities.

B. Research Instrument

Questionnaires were adapted from established instruments for undergraduate students at Saudi public universities measure the UTAUT constructs of performance expectancy [3], effort expectancy [3], social influence [3], facilitating conditions [3]), attitudes toward gamification [25], concentration [45, 46], and engagement [39, 47]. A 5-point Likert scale was employed in this study to measure participants' responses regarding their attitudes and engagement with gamification. This scale was chosen due to its widespread use in social science research, offering a balanced range of response options that capture varying degrees of agreement or disagreement. The 5-point scale is also simple for respondents to understand and complete, reducing response fatigue. Compared to alternatives like a 7-point or 10-point scale, the 5-point Likert scale is considered more practical for larger sample sizes, as it maintains clarity and ease of use without overwhelming participants with too many response options. Additionally, research has shown that the 5-point scale is effective in capturing reliable and valid data, particularly in educational and behavioral studies.

The adaptation process involved the following steps:

Translation: The original instruments were translated from English to Arabic by two bilingual researchers with expertise in education and psychology.

Back-translation: The translated instruments were then back-translated into English by two different bilingual researchers to ensure accuracy and cultural appropriateness.

Expert review: A panel of experts, including educators, psychologists, and language specialists, reviewed the translated and back-translated instruments to identify any discrepancies or ambiguities.

Pilot testing: The adapted instruments were piloted with a small group of undergraduate students in Saudi Arabia to assess their clarity, comprehensibility, and relevance to the local context.

Revisions: Based on the feedback from the pilot testing, necessary revisions were made to the instruments to improve their clarity, comprehensibility, and cultural appropriateness.

Through this rigorous adaptation process, the researchers ensured that the instruments were culturally appropriate, reliable, and valid for use in the Saudi Arabian context.

Performance expectancy (4 items) was adapted from Venkatesh *et al*. [43] to measure the perceived usefulness of gamification (e.g., "Gamification helps me improve my learning performance"). Effort expectancy (4 items) was also adapted from Venkatesh *et al*. [43] to assess the perceived ease of use (e.g., "Using gamification is simple for me"). Social influence (3 items) was adapted from Venkatesh *et al*. [43] to measure perceived social pressure (e.g., "People important to me encourage me to use gamification"). Facilitating conditions (4 items) were adapted from Venkatesh *et al*. [43] to assess perceived resource availability (e.g., "I have the necessary resources to effectively use gamification").

Attitudes toward gamification (3 items) were adapted from Davis *et al*. [25] and Fathema *et al*. [48] (e.g., "Using gamification in education is beneficial"). Concentration (4 items) was adapted from Csikszentmihalyi [49] which was applied in the study by Hamari and Koivisto [50] to measure focus and engagement (e.g., "Gamification helps me maintain focus throughout the learning activity"). Engagement was measured using constructs defined by Handelsman *et al*. [50], combining skill engagement (3 items) and participation/interaction engagement (4 items) for a total of 7 items [39] (e.g., "Gamified learning activities motivate me to actively participate in class discussions").

IV. Data Analysis and Results

The research framework of the present investigation was evaluated using Structural Equation Modeling (SEM) via Partial Least Squares (PLS) [51]. Smart PLS 4 software was mainly utilized [51]. This robust, substantial statistical procedure [52] does not require strict assumptions concerning the distribution of the variables [52]. In addition, this technique is appropriate in complex causal analysis situations [52]. Nevertheless, based on subsequent prior recommendations [53, 54], our PLS analysis employed 5,000 subsamples to generate bootstrap t-statistics with n-1 degrees of freedom (where n is the number of subsamples) to examine the statistical significance of the path coefficients. To understand and analyze the research model, PLS involves a two-stage analysis: the analysis of the measurement model to ensure the validity and reliability of the scales and the structural model analysis that allowed us to test the hypotheses.

A. Model Development and Indicator Selection

The research model was developed based on the theoretical framework and hypotheses outlined in the previous sections. The following steps were involved in developing the model:

Identification of constructs: The key constructs in the model were identified based on the theoretical framework and research questions.

Selection of indicators: For each construct, a set of indicators was selected based on their relevance to the construct and their ability to capture its underlying dimensions. The indicators were chosen from existing literature and adapted to the specific context of this study.

Measurement model development: The measurement model was developed to assess the validity and reliability of the indicators. Confirmatory factor analysis was used to evaluate the fit of the measurement model and to identify any modifications that were needed.

Structural model development: The structural model was developed to test the hypothesized relationships among the constructs. The model was based on the theoretical framework and the research hypotheses.

B. Minimization Common Method Bias

To address the potential for common method bias (CMB) in this study, both procedural and statistical measures were implemented. Procedurally, diverse measurement scales and assurances that ensured no correct or incorrect answers were used to minimize bias. The data collection took place in two phases: an introduction to gamification technology followed by a questionnaire at the semester's end, which assessed attitudes, engagement, and interaction (Table 1).

Table 1. Common method variance assessment via full collinearity estimate criteria

Components	Performance Expectancy	Effort Expectancy	Social Influence	Facilitating Condition	Attitude Toward Using Gamification	Students' Concentration	Skill Engagement	Participation Engagement
VIF	1.121	1.114	1.141	1.137	2.101	1.258	1.631	2.114

Note: VIF = Variance Inflation Factor

Statistically, Harman's single-factor test was employed, revealing no dominant factor explaining the covariance among items. The first component accounted for only 23% of the total variance, indicating that CMB was not a major concern in this study [55]. Furthermore, a collinearity analysis using variance inflation factors (VIFs) showed a maximum VIF of 2.114, which is well below the threshold indicating significant collinearity. These findings suggest that common method bias is not a significant issue, ensuring the integrity of the results and interpretations drawn from the data [56, 57].

C. Construct Validity and Reliability

To develop the measurement model, we evaluated the reliability of individual items, internal consistency reliability, convergent validity, and discriminant validity. Regarding item reliability, the results suggest no significant issues; most items exceeded the recommended 0.707 level [53], as shown in Table 2. The internal consistency of the constructs was evaluated using Cronbach's alpha and Composite Reliability (CR), with values ranging from 0.701 to 0.859 and 0.705 to 0.861, respectively, which were above the 0.70 threshold [53]. The average variance extracted (AVE) was calculated to assess convergent validity, with values between 0.594 and 0.676, exceeding the 0.5 benchmark [53]. These results confirm that the constructs exhibited acceptable levels of internal consistency and convergence.

To ensure the model's discriminant validity, both Fornell-Larcker's method and the Heterotrait-Monotrait Ratio (HTMT) were employed. Fornell-Larcker's method revealed that the AVE for each construct was greater than the variance shared with other latent variables, while HTMT values for all construct pairs were below 0.90, with 95% confidence intervals not including 1, as displayed in Tables 3 and 4 [54]. This provides strong evidence that the constructs were distinct from one another.

The validity and reliability evaluations are crucial for ensuring the robustness of our findings. High item reliability and internal consistency suggest that the items consistently measure their intended constructs, while convergent and discriminant validity ensure that the constructs accurately represent the underlying concepts and are distinct from one another. These rigorous checks contribute to the overall reliability of our findings by minimizing measurement errors and confirming that the observed relationships between variables are reflective of true effects rather than artifacts of the measurement model.

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)
Performance Expectancy		PE-1	0.710	0.771	0.795	0.594
		PE-2	0.794			
		PE-3	0.798			
		PE-4	0.773			
Effort Expectancy		EE-1	0.763	0.831	0.858	0.662
		EE-2	0.787			
		EE-3	0.880			
		EE-4	0.729			
Social Influence		SI-1	0.786	0.764	0.791	0.676
		SI-2	0.819			
		SI-3	0.861			
Facilitating Condition		FC-1	0.812	0.805	0.830	0.629
		FC-2	0.774			

		FC-3	0.701			
		FC-4	0.780			
Attitude Toward Using Gamification		ATUG-1	0.810	0.709	0.723	0.633
		ATUG-2	0.860			
		ATUG-3	0.845			
Students' Concentration		SC-1	0.677	0.825	0.840	0.654
		SC-2	0.787			
		SC-3	0.868			
		SC-4	0.852			
Skill Engagement		SKE-1	0.828	0.701	0.705	0.626
		SKE-2	0.837			
		SKE-3	0.801			
Participation Engagement		PRE-1	0.791	0.859	0.861	0.543
		PRE-2	0.713			
		PRE-3	0.782			
		PRE-4	0.807			
	Students' Engagement	Skill Engagement	0.745	0.821	0.823	0.651
		Participation Engagement	0.890			

Table 3. Measurement model, discriminant validity via Fornell and Larcker criterion

Constructs	1	2	3	4	5	6	7
1. Attitude toward Using Gamification	***0.796***						
2. Effort Expectancy	0.450	***0.814***					
3. Facilitating Condition	0.486	0.541	***0.793***				
4. Performance Expectancy	0.426	0.737	0.481	***0.771***			
5. Social Influence	0.399	0.385	0.671	0.315	***0.822***		
6. Students' Concentration	0.447	0.339	0.379	0.325	0.332	***0.808***	
7. Students' Engagement	0.586	0.520	0.561	0.532	0.435	0.555	***0.737***

Note: 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	4	5	6	7
1. Attitude toward Using Gamification							
2. Effort Expectancy	0.560						
3. Facilitating Condition	0.623	0.658					
4. Performance Expectancy	0.549	0.922	0.605				
5. Social Influence	0.529	0.479	0.874	0.392			
6. Students' Concentration	0.579	0.391	0.434	0.403	0.392		
7. Students' Engagement	0.750	0.615	0.652	0.660	0.536	0.643	

D. Hypotheses Testing

Table 5 shows the results of the direct effect hypotheses (H1 to H5). Hypothesis 1 (H1) proposed a direct relationship between performance expectancy and attitude toward using gamification. The analysis revealed a statistically significant positive relationship (β = 0.154, t = 3.412, p < 0.000), supporting H1. This result suggests that as users' expectations of how gamification can enhance their performance increase, so does their positive attitude toward its use, confirming the hypothesis.

Similarly, Hypothesis 2 (H2) posited that effort expectancy would positively influence attitude toward using gamification, and this was also supported (β = 0.157, t = 3.545, p < 0.000). The significant positive relationship indicates that when users find gamification easy to use, their attitude toward its use improves, providing strong support for H2.

Hypothesis 3 (H3), which suggested a link between social influence and attitude toward using gamification, was likewise supported (β = 0.128, t = 2.583, p < 0.000), confirming that users are more likely to adopt gamification if they perceive that others around them encourage its use.

Hypothesis 4 (H4) examined the relationship between facilitating conditions and attitude toward gamification. The significant result (β = 0.242, t = 4.672, p < 0.000) supports H4, demonstrating that when users perceive adequate resources and support, their attitude toward using gamification strengthens.

Hypothesis 5 (H5), which explored the direct effect of students' attitude toward gamification on their engagement, was strongly supported (β = 0.422, t = 11.590, p < 0.000), indicating that a positive attitude toward gamification significantly enhances students' engagement.

Additionally, the interaction test (moderation) revealed that the relationship between attitude toward using gamification and students' engagement is stronger when students' concentration is high rather than low (β = 0.231, t = 2.204, p < 0.001). This result underscores that concentration acts as a crucial moderating factor in enhancing engagement through positive attitudes toward gamification, reinforcing the hypothesized moderation effect.

By confirming each of these hypotheses with statistically significant results, the findings provide robust support for the proposed relationships. The results not only validate the individual hypotheses but also highlight the broader

implications for understanding how factors like performance and effort expectancy, social influence, and facilitating conditions shape users' attitudes toward gamification, and ultimately, their engagement.

Table 5. Hypotheses test

Hypothesis	Direct Effect	Original sample	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Decision
H-1	Performance Expectancy ≥ Attitude toward Using Gamification	0.154	0.045	3.412	0.000	Supported
H-2	Effort Expectancy ≥ Attitude toward Using Gamification	0.157	0.044	3.545	0.000	Supported
H-3	Social Influence ≥ Attitude toward Using Gamification	0.128	0.049	2.583	0.005	Supported
H-4	Facilitating Condition ≥ Attitude toward Using Gamification	0.242	0.052	4.672	0.000	Supported
H-5	Attitude toward Using Gamification ≥ Students' Engagement	0.422	0.036	11.590	0.000	Supported
Interaction Effect (Moderation)						
H-6	Students' Concentration x Attitude toward Using Gamification ≥ Students' Engagement	0.231	0.036	2.204	0.001	Supported

To test our predicted moderation hypothesis (H6), as shown in Table 5, the interaction term "attitude toward using gamification x students' concentration toward students' engagement" was significant. Thus, it is important to interpret this interaction. Following the recommendations, the regression was plotted for high versus low student concentration. The results indicate that the positive relationship between attitude toward using gamification and students' engagement is more substantial (with a more pronounced slope) when students' concentration was high than low (Fig. 2). This supports H6.

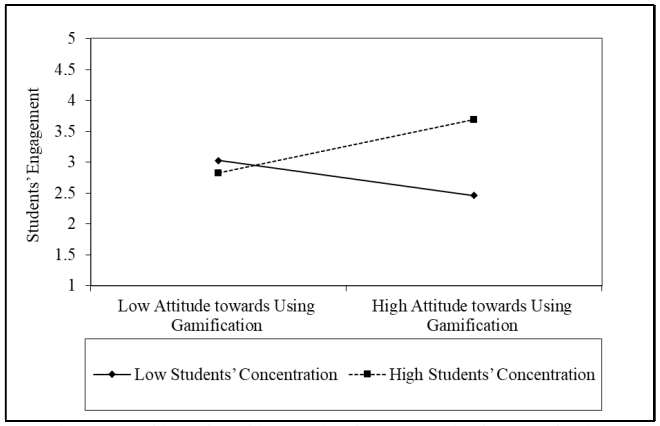

Fig. 2. Graphing plot of interaction between attitude toward using gamification x students' concentration toward students' engagement.

E. Assessment of the Predictive R^2

The R-squared value quantifies a model's predictive accuracy by measuring the correlation between observed and predicted values of an outcome variable. It essentially represents the proportion of variance in the outcome explained by the predictor variables. R-squared values range from 0 to 1, with higher values indicating a better-fitting model. As a general guideline, Hair *et al*. (2017) suggests specific R-squared cutoffs for evaluating model fit as follows:

R^2 0.75 → Substantial

R^2 0.50 → Moderate

R^2 0.25 → Weak

Regarding the power of explanation, the model explains values of R-square 0.532 and R-square adjusted 0.530 for student involvement, indicating a moderate-to-significant effect (Hair *et al*., 2017).

V. Discussion

The application of gamification in education has garnered significant attention as a potential means of enhancing student engagement, motivation, and learning outcomes. This comprehensive discussion critically analyzes this study's findings on the effectiveness of gamification in education teaching within the cultural context of Saudi Arabia.

The proposed relationships between performance expectancy, effort expectancy, social influence, and facilitating conditions in the context of using gamification as an educational technique have demonstrated significant and positive effects on students' attitudes toward its implementation, consequently influencing student engagement levels among undergraduate students in public universities in Saudi Arabia. Performance expectancy, which relates to gamification's perceived effectiveness and utility in enhancing learning outcomes, was found to play a pivotal role in shaping students' attitudes. When students believe that gamification can improve their academic performance, their attitudes toward its use become more favorable. Regarding effort expectancy, focusing on the perceived ease of use and integration of gamification into the learning process also has a substantial impact. When students find gamification tools and methods user-friendly and accessible, their willingness to engage with them increases, leading to a more positive attitude toward gamification and, subsequently, higher levels of engagement.

Moreover, the influence of social factors must be considered. Social influence, encompassing peer and instructor support and endorsement of gamification, encourages students to view it as a valid and accepted educational approach. When students perceive that their peers and instructors value gamification, their attitudes toward its use become more positive. The facilitating conditions, which refer to the availability of resources and support for gamification implementation, are crucial in enabling students to engage with gamified learning activities effectively. When

students access the necessary tools and guidance, their attitudes toward gamification become more favorable, and their engagement levels are more likely to increase [29].

Furthermore, the moderating role of students' concentration in the relationship between attitude toward using gamification and student engagement is noteworthy. Concentration levels among students in a gamified learning environment can significantly impact the translation of a positive attitude into actual engagement. High concentration levels may lead to more profound skill and participant engagement, as students can better immerse themselves in gamified tasks and activities. In contrast, lower concentration levels may weaken this relationship.

Thus, the interplay of performance expectancy, effort expectancy, social influence, and facilitating conditions shape students' attitudes toward gamification in the context of Saudi Arabian public universities. These attitudes, in turn, substantially impact both skill engagement and participant engagement. The moderating role of students' concentration underscores the importance of creating an environment conducive to sustained attention and immersion, as it can significantly influence the extent to which a positive attitude toward gamification translates into meaningful student engagement. This insight is essential for educators and policymakers seeking to leverage gamification effectively to enhance undergraduate students' educational experience in Saudi Arabia. The findings are drawn from recent research and supported by relevant citations and references, providing a robust foundation for understanding the dynamics in this educational context [8].

A. Theoretical Implications

In terms of theory, the study contributes to a better understanding of the relationship between students' attitudes regarding utilizing gamification and their participation. It offers insight into the moderating function of students' concentration. This useful finding adds to our understanding of the elements that determine the effectiveness of gamification in educational contexts. The study's results may contribute to advancing theoretical frameworks related to gamification, learning motivation, and student engagement, helping researchers develop more nuanced and comprehensive models. However, a few studies have used the UTAUT to explain attitudes toward using gamification (e.g., de Oliveira *et al*., 2019; Dwivedi *et al*., 2020) [22, 23].

Nevertheless, these studies examined only the relationship between the UTAUT components (i.e., performance expectancy, effort expectancy, social influence, facilitating conditions) and attitude toward using gamification. The current study expanded the knowledge by examining the UTAUT model and attitude toward using gamification. Subsequently, the effect of attitude toward using gamification on the student's engagement (i.e., skill engagement and participant engagement) in using gamification among Saudi undergraduate students could also be gauged. Most significantly, this study also contributed to the body of knowledge by extending the UTAUT model by introducing students' concentration as a boundary condition (moderation) on the relationship between attitude toward using gamification and student engagement. The results of this study could help improve instructional design for the higher education.

B. Practical Implications

The study's implications are equally important for policymakers in the education sector, who can leverage the findings to inform decisions to integrate gamification into the curriculum. By recognizing the interplay between attitude, concentration, and engagement, policymakers can design and implement gamified learning experiences for students' differences and needs. For instance, initiatives could focus on providing additional support and resources to help students improve concentration and focus, thereby maximizing the impact of gamification on their engagement. Policymakers may also consider developing guidelines and best practices for educators to effectively integrate gamification into teaching methods, ensuring that gamified learning experiences align with educational objectives and foster positive attitudes and sustained student engagement. Overall, the study's implications provide valuable guidance for theoretical advancements in gamification and informed decision-making for policymakers in education. By considering the role of students' concentration as a moderating variable, future research can build upon these insights to further enhance the design and implementation of gamified learning experiences, ultimately leading to improved student engagement and learning outcomes in educational settings. Therefore, the implications for policymakers of gamification in education in Saudi Arabia are significant and hold the potential to impact the learning experiences of students positively. Gamification, integrating game elements and mechanics into educational activities, offers a promising approach to engaging students, enhancing their motivation, and fostering more profound learning.

Firstly, policymakers in Saudi Arabia can consider the adoption of gamification as a strategy to address student engagement challenges. With gamified learning experiences, students would likely become more active and enthusiastic participants in the educational process. This can lead to improved attendance, reduced dropout rates, and a more positive learning environment. Secondly, incorporating gamification into the curriculum can address diverse learning styles and preferences. Saudi Arabia has a multicultural and multilingual population, and gamification offers the flexibility to adapt content and assessments to suit individual needs. Policymakers can work with educators to develop gamified materials that are culturally relevant and align with national educational objectives.

Furthermore, policymakers should invest in professional development and teacher training to effectively implement gamification in their classrooms. Teachers need support in understanding how to design and implement gamified learning experiences that align with the curriculum and learning objectives. Offering ongoing training and resources will empower educators to utilize gamification as an effective teaching tool. The most effective types of training include hands-on workshops, collaborative learning sessions, and mentorship programs where teachers can actively engage with gamification tools and strategies. Additionally, providing access to digital resources, case studies, and communities of

practice can support teachers in sharing best practices and troubleshooting challenges. Continuous professional development that emphasizes practical application, peer collaboration, and feedback will ensure that educators are equipped with the skills and confidence needed to integrate gamification successfully.

Another implication for policymakers is to leverage gamification to promote skills development and critical thinking. By integrating problem-solving challenges, teamwork activities, and interactive quizzes, gamified learning experiences can enhance students' cognitive abilities and soft skills, preparing them for the demands of the 21st-century workforce. Additionally, policymakers should consider conducting research and evaluating the effectiveness of gamification in Saudi Arabian educational contexts. Policymakers can make evidence-based decisions on scaling up gamified learning initiatives by collecting data on student outcomes, engagement levels, and teacher perceptions. Lastly, while embracing gamification, policymakers should be cautious about potential challenges, such as ensuring equitable access to technology and addressing concerns about screen time. Policies can be developed to ensure that gamification initiatives are inclusive and considerate of students' backgrounds and circumstances.

VI. Conclusion

Gamification, the integration of game-like elements into educational contexts, has emerged as a promising strategy for enhancing student engagement, motivation, and learning outcomes By incorporating elements such as points, badges, leaderboards, and challenges, gamification can create a more immersive and enjoyable learning experience. This can lead to increased student participation, improved retention of knowledge, and a more positive attitude toward learning. Additionally, gamification can promote critical thinking, problem-solving skills, and collaboration among students.

The study's findings highlight the importance of creating a supportive and inclusive learning environment to enhance students' concentration and engagement in gamified learning. Previous research has demonstrated that clear goals, appropriate challenges, and personalized feedback can significantly impact student concentration and motivation. Additionally, creating a positive and inclusive classroom atmosphere can also contribute to improved student focus and motivation. Future research could explore these factors in more detail to provide practical strategies for educators to enhance student concentration and maximize the benefits of gamification.

In conclusion, the implications for policymakers of gamification in education in Saudi Arabia are enormous. By embracing gamified learning experiences, policymakers can enhance student engagement, cater to diverse learning needs, and foster skills development. Through thoughtful planning, investment in teacher training, and evidence-based decision-making, gamification can contribute to a more effective and engaging educational landscape in Saudi Arabia.

This research offers valuable insights into the relationships between performance expectancy, effort expectancy, social influence, and facilitating conditions in the context of using gamification to influence attitudes and student engagement among undergraduate students in Saudi Arabian public universities. However, several limitations should be noted.

First, the reliance on self-reported data may introduce response bias, potentially leading to inaccurate representations of behaviors and attitudes. Future studies could incorporate objective metrics like platform usage data and observational methods for a more accurate understanding, alongside qualitative approaches such as focus groups to deepen insights. Mixed methods or physiological measures (e.g., eye-tracking) could also provide more robust findings on real-time interactions with gamification.

Second, the focus on Saudi Arabia may limit the generalizability of the findings to other cultures. Future research should explore how cultural factors like individualism-collectivism influence gamification's effectiveness, with comparative studies across countries such as the U.S. and U.K. to identify cross-cultural patterns.

Third, the study highlights the need to investigate specific gamification elements (e.g., leaderboards, badges) that enhance engagement across cultures. Lastly, while the study examined concentration as a moderating factor, it did not explore what influences concentration. Future research could investigate the roles of motivation, digital distractions, and learning environments in shaping concentration levels.

Addressing these limitations and exploring future research directions will further our understanding of how gamification can improve student engagement and attitudes in higher education, particularly within Saudi Arabia's unique cultural context.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

In this research paper, Ahmed Freeh Allehaidan conducted the work under the supervision and guidance of Wan Mohd Nazmee Wan Zainon, who provided mentorship and oversight throughout the research process. All authors had approved the final version.

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