Towards Gamified Acceptance in eLearning Systems: Students' Perspective at Iraqi Higher Education Institutions

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***Abstract*—The study investigates the factors influencing students' continuance intention to use gamified eLearning applications in higher education institutions in Iraq by using an extended Technology Acceptance Model (TAM) integrated with constructs from the Unified Theory of Acceptance and Use of Technology (UTAUT2). The study identifies key determinants, perceived ease of use, perceived usefulness, hedonic motivation, facilitating conditions, and design quality, and analyzes their impact on student engagement. This study adopts a quantitative approach using a survey conducted among a diverse group of 163 students from various academic disciplines. Structural Equation Modeling (SEM) is employed to test the proposed framework. The findings reveal that perceived ease of use, facilitating conditions, and design quality significantly influence continuance intention, reflecting students' growing self-reliance in managing technology. Perceived usefulness and hedonic motivation showed no substantial impact. This study advances theoretical understanding by extending TAM and integrating UTAUT2 into a gamified context and highlights practical implications for developers and educators. It recommends prioritizing usability, design quality, and institutional support to enhance gamified eLearning applications, fostering sustained student engagement in Iraq's eLearning system.**

***Keywords*—continuance use intention, design quality, gamified e-learning, Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology 2 (UTAUT2)**

I. Introduction

The integration of gamification into education is a major trend in higher education, especially in eLearning systems. Institutions worldwide are adopting gamified methods to boost student engagement and motivation. They apply game design elements in non-game contexts. Gamification is the use of game design elements like points, badges, leaderboards, and challenges in non-game contexts, which have emerged as a major pedagogical innovation to address the limitations of traditional learning models [1]. This is especially relevant for Iraq, where rapid socio-economic changes and advancing technologies are reshaping the educational landscape. Gamification is the concept of providing game-like experiences to users with the use of gamification processes and elements [2]. Examples of gamified eLearning applications in Iraqi institutions include e-quiz [3], Moodle, Edmodo, and proprietary systems with Arabic language support and culturally relevant content [4]. For example, game-based quizzes and interactive simulations have been used in the Science, Technology, Engineering, Mathematics (STEM) subject area to actively encourage participation and critical thinking. Such applications would be very relevant in this context, especially since traditional didactic methods greatly dominate this area, and student-centered learning is less emphasized.

Gamified learning apps enhance learners' intrinsic and extrinsic motivation, thereby improving engagement and learning outcomes [5, 6]. The use of such Learning Management Systems (LMS) in higher education institutions has substantially aided learners in knowledge reinforcement and retention [6, 7]. Few higher education institutions have responded by drastically changing teaching and learning methodologies to answer twenty-first-century exigencies. The current trend in eLearning apps is integrating gamification principles that embody playful and fun components [1] in what has come to be referred to as a "gamification-based" or "gamified" eLearning application.

Despite the increase in adoption and the benefits of gamified learning approaches, many students in higher education institutions in Iraq exhibit low rates of sustained engagement with gamified eLearning applications. This trend has led to a set of critical questions focused on ascertaining the factors that shape the continuation intention of students using these technologies, hence requiring extensive research into their perceptions and experiences [8]. Therefore, this study hope to address the issue of low rate in continuance usage of gamified eLearning applications among students in Iraqi higher education institutions. First, the initial adoption of such technologies does not mean students will continue to use them. Most students have been found to depict a lack of continued interaction with gamified systems and their academic performance, as well as the general learning experience, becomes adversely impacted by such disengagement [9]. This disengagement can be researched using established theoretical frameworks like the Technology Acceptance Model and Unified Theory of Acceptance and Use of Technology, UTAUT2. TAM assumes that perceived ease of use and perceived usefulness are powerful predictors of users' intentions to adopt new technologies [10]. From this angle, UTAUT2 introduced new concepts such as facilitating conditions and hedonic motivation, making the explanation of technology acceptance in learning-related settings even more complex [11]. Many of these theoretical grounding models, however, have so far been without actual empirical testing in gamified eLearning apps, to say nothing of the Iraqi.

Iraqi education faces unique challenges in adopting technology due to intertwined infrastructural limitations, pedagogical traditions, and cultural norms. Universities are confronted with the challenge of sporadic internet connections, variable availability of electricity, and limited access to advanced equipment, thus being the gargantuan challenges of the use of eLearning platforms [12]. At the

cultural level, the education system remains very instructor-centric, and conventional lecture-based approaches dominate, which may generate resistance towards student-centric gamification-led practices [13]. Furthermore, the rapid transition to eLearning during the COVID-19 pandemic happened frequently and without proper faculty or student training, leading to anti-adoption and discontent [8].

Political and economic instability discourages long-term investment in educational technology, leading to poorly implemented or outdated systems. These environmental factors—infrastructure shortfalls, teaching practices, and system instability—explain why more traditional TAM and UTAUT2 constructs like perceived usefulness and hedonic motivation can behave differently within Iraq. Compared to Western contexts, and why theory-adjusted theoretical constructs are required here.

The question raised to be answered is, "What is the impact of Iraq's compulsory gamified eLearning environment on continuance intention by exploring (1) the relationship between Perceived Ease of Use (PEOU) and Design Quality (DQ) on adoption, (2) the significant relationship of Perceived Usefulness (PU) with continued adoption as one of the major construction TAM models, (3) the effect of Hedonic Motivation (HM) in comparison to voluntary adoption environments, and (4) the contribution of Facilitating Conditions (FC) in resource-constrained Iraqi universities. As such, it analyzes students' perception of elements in gamification, together with the impacts these elements could have on motivation and engagement in studying and then identifies possible barriers preventing continued use. It is important to stress that this study is significant not only because it will contribute to the corpus of academic literature, but also because it has practical implications for enhancing educational practices and outcomes in Iraqi higher education institutions. This research intends to solve theoretical gaps by expanding current models, such as TAM and UTAUT2, with actual data on gamified eLearning applications.

The study uses an extended version of the Technology Acceptance Model (TAM) [14] to investigate the determinants of continued intention to use a gamified learning app. The model incorporates factors from the Extended Unified Theory of Acceptance and Use of Technology (UTAUT2) [15], which is a pre-acceptance framework. First, this study blends the exploratory parts from the TAM model with the relevant determinants from the UTAUT2, which stands for the explanatory elements [16]. Second, by exploring the factors that influence learners' willingness to continue using the gamified mobile learning application, the greater body of knowledge on this issue may be expanded. is important since earlier eLearning IT research investigated the early acceptability of gamified m-learning apps, but this study focused on the post-acceptance stage of usage. However, the current study focuses only on higher education in Iraq, specifically on students enrolled in different academic programs who have used gamified eLearning tools. This emphasis provides for a thorough evaluation of student views while narrowing the scope to that particular environment.

Furthermore, the technological infrastructure of the institutions can create variations in how students experience gamified applications. The remainder of this paper is organized as follows: Section II presents a comprehensive Literature Review, situating the study within existing research on gamification and eLearning. Section III details the Materials and Methods, including data collection procedures and analytical techniques. Section IV presents the Results and Discussion, interpreting the findings from the data analysis. Section V provides the Conclusion, summarizing key insights and offering recommendations for future research.

II. Literature Review

A. Theoretical Background

1) Technology Acceptance Model (TAM)

The most influential framework in understanding user acceptance of technology is developed by Davis [14], known as the Technology Acceptance Model (TAM). TAM identifies two key constructs that determine technology adoption: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). Perceived usefulness refers to the degree to which a user believes that using a system will enhance their job performance, while perceived ease of use reflects the degree to which a person believes that using a system would be free of effort [14]. These constructs jointly influence the user's attitude toward using the technology, which subsequently affects behavioral intention and actual usage. Other studies have proved and generalized TAM to apply in other contextual constructs. Venkatesh *et al.* [17] developed TAM2 involving subjective norms and cognitive instrumental processes. In that sense, further, TAM3 was developed concerning the involvement of experience, voluntariness, and computer anxiety as described by Venkatesh and Bala [18]. It gives a good explanation of how the model can easily adapt to diverse explanations, including those like eLearning and gamified systems. The Technology Acceptance Model is shown in Fig. 1.

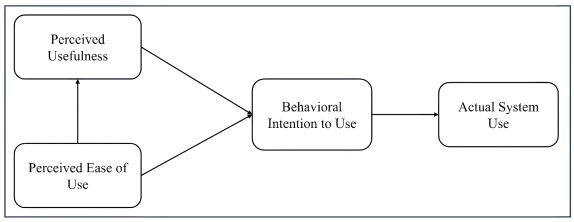

Fig. 1. The technology acceptance model.

In recent years, TAM has been widely used to simulate user behavior in the gamified eLearning environment. An analysis by Tam *et al.* [19] indicated that PU would have a considerable effect on students' adoption of a mobile learning application, whereas PEOU played a secondary function. Similarly, Akdim *et al.* [20] discovered that using felt pleasure as a Hedonic Motivation boosted the explanatory value of TAM in a gamified environment. The findings emphasize the significance of TAM in determining user engagement and continuing use of instructional technologies. Despite broad use, TAM has been criticized for failing to consider critical social and cultural elements that may impact technological uptake. As a result, academics have attempted to combine TAM with other theories, such as

the Unified Theory of Acceptance and Use of Technology, to achieve a more comprehensive understanding of user behavior [20].

2) Unified Theory of Acceptance and Use of Technology (UTAUT2)

The Unified Theory of Acceptance and Use of Technology, created [21], included elements from eight theoretical frameworks, including the Theory of Acceptance and Use of Technology (TAM), the Theory of Planned Behavior (TPB), and the Social Cognitive Theory. The UTAUT2 model outlines four key factors that determine behavioral intention and use behavior: performance expectation, effort expectancy, social influence, and enabling circumstances. In these associations, the moderators are age, experience, gender, and voluntariness of use. Price value, habit, and hedonic drive were added to UTAUT2 to increase its usefulness in consumer situations [21]. Hedonic motivation refers to the joy of utilizing technology and has been demonstrated to be particularly essential in gamified applications. Habit is the degree to which people's activities are habitual, and price value is the trade-off between the advantages and drawbacks of using technology.

According to Akdim *et al.* [20], the primary factors influencing technology acceptance in the pre-acceptance or pre-adoption phase are social influence, facilitating conditions, performance expectancy (perceived usefulness), and effort expectancy (perceived ease of use). Fig. 2 depicts the Extended Unified Theory of Acceptance and Usage of Technology (UTAUT2), which was created by Ursavaş [21] to improve the applicability of UTAUT in a consumer usage setting. There are three more variables: hedonic motivation, price value, and habit. Hedonic incentive and price value relate only to intent to use, whereas habit is linked to both intent and actual usage. Furthermore, UTAUT2 incorporates a novel interplay between the intention to use and the enabling conditions. Because consumption in a consumer context is always voluntary, UTAUT2 eliminates the moderating variable of volitional use. Instead, it alters the relationship between use and aims by offering experience.

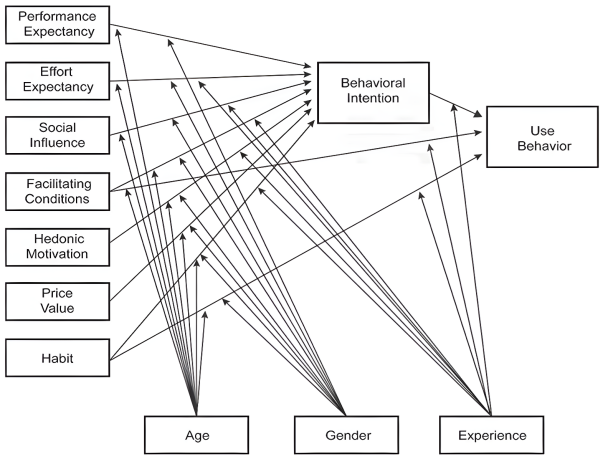

Fig. 2. The extended Unified Theory of Acceptance and Usage of Technology (UTAUT2).

Previous research noted that moderators are typically not examined in studies because they lack application, and most studies that used UTAUT as a conceptual basis included only a portion of the applicable factors to assess the intention to continue using technology [22–24]. For example, Amadiok *et al.* [25] assessed eLearning uptake among Ghanaian tertiary students during the COVID-19 epidemic, while Tam *et al.* [19] conducted a mobile app research study with students from Lisbon, Portugal. In other words, UTAUT2's pre-acceptance model may offer value to a post-acceptance model to identify numerous elements that will impact the technology-based intention to continue usage.

B. Constructs in TAM and UTAUT2

1) Perceived ease of use

One of the fundamental characteristics, perceived ease of use, exists in both TAM and UTAUT2, which has significant consequences for user acceptance behavior in terms of technology [14, 15]. It refers to a user's belief that using a certain technology would not involve much effort [26]. In the case of gamified eLearning applications, perceived ease of use would strongly encourage students to utilize such systems for an extended length of time. Students would get dissatisfied and distracted if they were unable to utilize or navigate the game features effectively, resulting in reduced rates of sustained use [8]. Several empirical studies have shown that perceived ease of use is closely connected to user satisfaction and sustained usage of educational technology. For example, research performed by Ahmed *et al.* [12] has shown that students who can simply utilize their application are more likely to express better satisfaction ratings and increased propensities of using it. This implies that the interfaces of gamified eLearning applications should be user-friendly enough to allow interactivity. Nonetheless, despite a profusion of studies emphasizing the importance of perceived ease of use in technology adoption, there is a significant vacuum in terms of its benefits in gamified environments. Most studies have focused on conventional instructional technology, failing to effectively address the topic of how game mechanics will alter users' perspectives. The present research evaluated how perceived ease of use influences students' desire to continue using gamified eLearning applications in Iraq.

2) Perceived usefulness

This is another major aspect of TAM, since it may affect user intentions to adapt to recent technologies based on their views. It refers to how strongly users believe that using a specific system would enhance their job performance or learning outcomes [26]. In the case of gamified eLearning software, perceived usefulness has to do with how much such software enhances students' academic achievement or overall learning. Research indicates that students are more inclined to use an application if they perceive it to be useful, i.e., it enhances their comprehension or memory of course content. For example, gamification has been shown to improve information retention by making learning sessions more engaging and entertaining [27]. Despite the obvious links between perceived usefulness and user engagement, there have been little empirical research on this topic in Iraqi higher education institutions. Understanding the influence of perceived usefulness on students' willingness to continue using gamified eLearning programs is essential for having successful educational tools that are personalized to their

unique requirements. Particularly in the scenario of Iraqi universities, where conventional pedagogy is dominant, the research attempts to satisfy an overarching lacuna in the existing literature about a connection between face-to-face experience and technologically facilitated pedagogy.

3) Facilitating conditions

Facilitating conditions are resources and support while using technology; they include everything that allows assessing if a user can successfully engage with a system over time [22]. In the context of gamified eLearning programs at Iraqi higher education institutions, properly designed interfaces that allow for navigation while including compelling game mechanics are critical for creating favorable user experiences. Empirical research has proven that facilitation conditions are of key significance in determining the willingness of users to utilize technology on a repeated basis. For example, one research study proved that if students have the pleasure of using stable technological facilities and support frameworks, such as training programs or help desks, then they will be more inclined to use pedagogical technologies repeatedly [23]. Even though it is pertinent, there is also an apparent knowledge gap for how enabling conditions affect the involvement of the user in gamified environments. Within the Iraqi higher-learning context, whose technology infrastructure varies, the factor of enabling conditions is more profound. A few schools suffer from erratic connections to the Internet and weak support systems, which may disrupt the interactive nature of students using gamified applications. This study would assist in determining the effect of facilitation conditions that develop in Iraqi higher education institutions on students' long-term commitment to embracing such technologies.

4) Hedonic motivation

Hedonic motivation refers to the intrinsic enjoyment that comes from utilizing technology, and the value received is mostly decided by one's level of involvement with digital technologies [12]. Hedonic motivation is relevant to gamification in eLearning since it explains how fun or entertaining learners find the learning process, including game elements. Multiple studies have shown that if learners find an application to be engaging or pleasant, which is a common phrase for good gamification, they are more likely to utilize it on a regular basis [27]. However, while recent research proving that hedonic incentive significantly increases user involvement in learning technology in general, actual evidence on its efficacy in gamified situations is few. The growth of gamified eLearning programs into more effective educational tools that match with students' preferences is critical to understanding how hedonic incentives impact ongoing desire to use them. In Iraq's higher education system, where traditional teaching methods are common, harnessing hedonic incentives with engaging game mechanics would enhance students' experiences. This relationship between Iraq's universities and student motivation, facilitated by technology-supported solutions such as gamification, will cover a significant vacuum in the current literature while also providing practical knowledge for educators involved in innovation.

C. Design Quality

Design quality encompasses a variety of factors, including how effectively an application is organized and structured; it has a direct influence on user satisfaction and involvement with instructional technology [26]. The trick to obtaining a fantastic user experience with gamified eLearning courses used by Iraqi higher education institutions is to create new interfaces that are simple to use while also including inclusive interactive game features. Empirical studies have shown that effective design is connected with user happiness; a student who appreciates the program's appearance and finds it easy to navigate would likely express more pleasure, making him or her more likely to use the application in the long term [25, 26]. Although it is crucial, there is a significant knowledge gap in understanding how design quality influences user involvement in certain gaming settings, especially when the tools are educational and intended to enhance learners' experiences. Within the Iraqi university context, where technological advancement is so diverse, there is an even greater need to ensure high-level design, as many institutions are plagued by inconsistent interfaces or ill-designed functionalities that interfere with students' proper interaction with their respective platforms [17]. This study examines how the quality of design influences students' continued intention to use such technologies, providing valuable insight into institutional support mechanisms. It also outlines best practices for developing effective and engaging digital learning environments aimed specifically at improving student outcomes through innovative approaches such as gaming. Integration between TAM and UTAUT2.

D. The Integration of TAM and UTAUT2

The combination of TAM and UTAUT2 would therefore provide a comprehensive model for examining the acceptability of gamified eLearning. The model extends TAM by adding UTAUT2 constructs like hedonic motivation and facilitating conditions to better explain continuance intention. A study by He *et al.* [23] used a combined framework for examining gamified eLearning in Iraq. It indicates that hedonic motivation and facilitating conditions have a moderate influence on the relationship between PU and behavioral intention. By integrating the strengths of both TAM and UTAUT2, the integrated model in this study has environmental and individual-level factors, with holistic approach to the adoption of technology. The model constructs (such as social influence, price value, habit) from the Iraqi eLearning research is justified by the mandatory take-up environment and infrastructural limitations, superseding voluntary, consumer-driven factors with usability, quality design, and institutional support. Cultural collectivism and availability limitations then impose additional priority on system use functionality and access over hedonic or cost factors, aligning theoretical adaptation with local socio-technical conditions [28]. Future studies should strengthen this model via the inclusion of cultural and infrastructure attributes unique to Iraq [12, 22]. Some constructs were excluded in the present model, as justified by lack of research into learners' long-term use intentions, cultural and infrastructure attributes unique to Iraq, more so where gamification-based or mobile learning apps are involved [29, 30]. Whereas behavior intention and use behavior have been linked in the past with the pre-acceptance

stage of technology [21], continuation use intention is linked with the post-acceptance stage. Hierarchical, instructor-led pedagogy prioritizes compliance over individual enjoyment (HM), rendering competitive gamification elements (e.g., leaderboards) socially disruptive. Unreliable internet and outdated hardware amplify cognitive load, marginalizing *HM* and necessitating robust *FC* (e.g., offline functionality).

E. Gamified eLearning in Iraq

The utilization of gamified eLearning applications in Iraq represents a breakthrough achievement in education and is aligned with international trends in emphasizing the value of a challenging and dynamic learning environment. Gamification as the application of game elements into a non-game situation has proven to increase the motivation and engagement of students by providing them with enjoyable learning [31]. Gamified apps provide a promising opportunity for activating learning and consolidating knowledge acquisition in Iraq, where higher education institutions are progressively using digital technologies in teaching and learning processes to improve learning outcomes [13]. Despite all the potential benefits of gamified eLearning, most Iraqi students have shown lower rates of continuous engagement with the programs. This growth raises the question of what motivates students to keep using gamified devices, which necessitates a thorough analysis of their experiences and attitudes [8]. Iraqi institutions are limited by meagre resources or issues with the gamified eLearning implementation. Many institutions are constraint by small technology infrastructures, and this could make it difficult for learners to access and utilize gamified apps [8, 26]. However, cultural factors can influence the attitude of the students toward gamification; for example, some students can be discouraged by competitive factors and therefore lose interest [26]. In addition, there is a huge shortage of empirical research on gamified eLearning in Iraq. Most past research concentrated on the initial acceptance of learning tools but not on their sustained use [19]. This disparity is also concerning since long-term participation is required for effective educational results.

1) Acceptance of gamified eLearning

Several theoretical frameworks that describe user behavior and technology adoption may be utilized to understand the acceptance of gamified eLearning applications. According to the Technology Acceptance Model (TAM), customers' intentions to accept recent technologies are highly impacted by their evaluations of their usefulness and ease of use [26]. Perceived utility in the context of gamified eLearning pertains to how much these elements enhance students' learning experience, whereas perceived ease of use indicates how readily students can engage with and traverse gamified parts [15]. These notions are particularly essential to grasping why, despite their initial delight, some students may cease utilizing gamified programs. Furthermore, other components like hedonic motivation and enabling conditions are added by the Unified Theory of Acceptance and Use of Technology (UTAUT2). Enabling circumstances indicate resources and support users can make available to themselves using the technology and largely dictate how long one continues the practice of an engaged gamified app [15]. Intrinsic motivations to use technology, he calls the hedonic motivations in using gamification; this will also be regarding rewards or competition of leaderboards related to a quest for additional knowledge [12]. These theoretical frameworks give full knowledge of how multiple aspects interact to affect students' acceptance and continued use of gamified eLearning systems. The acceptance of gamified eLearning programs has not been investigated experimentally, despite these observations. The bulk of research has centred on standard educational techniques, neglecting the specific dynamics that gamification presents.

2) Hypothesis development

The assumptions in this study are based on the integration of the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2), and the function of design quality. Each concept represents crucial aspects that determine user satisfaction and retention intentions in gamified eLearning systems.

F. TAM Constructs

1) Perceived Ease of Use (PEOU)

Perceived ease of use (PEOU) is the extent to which students feel that the gamified eLearning application is free of effort [14]. An easy-to-use interface and smooth navigation are crucial for fostering engagement and satisfaction with the system. Earlier research has shown that if users find technology to use, it positively impacts their assessment of its usefulness [32]. Therefore, the following hypotheses are advanced:

H01: Perceived Ease of Use (PEOU) positively influences the use of gamified eLearning systems.

2) Perceived Usefulness (PU)

Students perceive the usability of the gamified eLearning system in terms of how it increases their learning outcomes [14]. PU plays a more significant role in satisfaction and continuance intention because students like tools that help improve their performances. Empirical studies' evidence reveals that helpful technologies promote long-term use [33].

H02: Perceived Usefulness (PU) has a positive effect on the Continuance Intention (CI) of gamified eLearning systems.

G. UTAUT2 Constructs

1) Hedonic Motivation (HM)

Hedonic motivation reflects the enjoyment derived from using the gamified eLearning system. The integration of gamification elements such as points, badges, and leaderboards enhances user engagement by creating a fun and enjoyable learning experience [34]. Research consistently demonstrates that hedonic motivation is a significant predictor of continuance intention, especially in gamified contexts. Thus:

H03: Hedonic Motivation (HM) positively affects Continuance Intention (CI) in gamified eLearning systems.

2) Facilitating Conditions (FC)

Facilitating conditions refer to the availability of resources and support, such as technical infrastructure and user guidance, which enable effective system use [19]. Students are more likely to continue using gamified eLearning systems

when they have access to sufficient resources and support mechanisms. Therefore:

H04: Facilitating Conditions (FC) have a positive effect on the Continuance Intention (CI) of gamified eLearning systems.

H. Design Quality

Design quality implies the aesthetic as well as functional or usability aspects of the gamified eLearning system. High design quality enhances experience, satisfaction, and motivation which increases the likelihood to engage with and eventually continue using it [35]. Cognitive and emotional supporting aspects of such a system improve continuance intention. Therefore

H05: Design Quality (DQ) has a positive effect on the Continuance Intention (CI) of gamified eLearning systems.

The hypotheses systematically merge TAM (usability), UTAUT2 (motivation/support), and design quality to explain gamified eLearning adoption, with each construct tailored to Iraq's institutional context as illustrated in Fig. 3 research model.

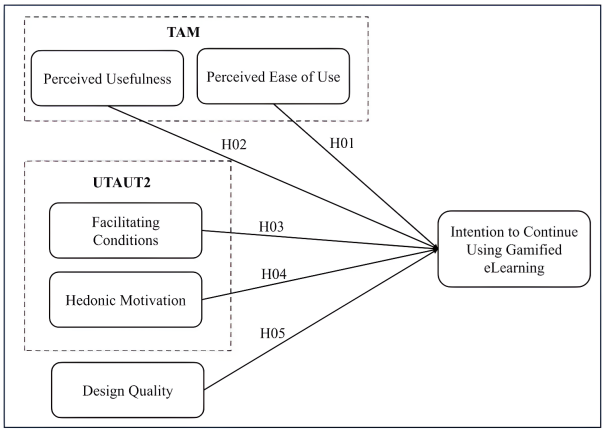

Fig. 3. Research model. Note: PEOU (Perceived Ease of Use); PU (Perceived Usefulness); FC (Facilitating Condition); HM (Hedonic Motivation), DQ (Design Quality), and IG (intention to Use Gamified eLearning).

III. Materials and Methods

A. Research Context and Participant

Students within higher education in Iraq are at the center of this study regarding perceptions of gamified eLearning systems. The participants consisted of undergraduate students from different academic disciplines, guaranteeing a balance of educational streams. The focus was on varying academic settings between public and private universities to ascertain the factors surrounding the acceptance and continuance of the gamified systems. Stratified random sampling was employed to ensure representation across Iraq's diverse higher education institutions. Technology adoption has been found to vary widely by institution type (public/private), field of study (STEM/humanities), and student technology proficiency [12, 22]. With this method, the representation of all subgroups that may influence gamified eLearning uptake is ensured under PLS-SEM criteria for robust subgroup analysis [36]. Earlier studies in similar contexts [29] validate that such stratification is necessary to reflect Iraq's highly documented institutional differences and digital readiness. While the study needs to justify its stratification, the method itself sufficiently addresses the heterogeneity of the population. This is because the use of digital learning tools in the higher education sector in Iraq has become increasingly significant as it improves the engagement and performance of students with the evolving trends in technology and pedagogy.

B. Measures

The instrument used in this research is based on reliable existing instruments that were adapted and modified to fit the aim and context of this study. Table 1 presents the final items with the source of the instrument. All items were measured using the 5-point Likert scale, ranging from strongly disagree (1), disagree (2), somewhat agree (3), agree (4), to strongly agree (5). Before collecting data, a pretest was conducted in which the items of the survey were administered to five experts for evaluation. Then, a pilot test for students from the previous cohort of student enrollment was conducted to check the reliability of items at the preliminary stage.

C. Data Analysis

A multivariate coefficient was employed to examine the 163 final data for multivariate normality before the model was tested. According to Mardia [37], one way to determine multivariate normality is the multivariate coefficient. According to Mardia's coefficient approach, the data was non-normally distributed, as the kurtosis coefficient ($\beta = 103$) was greater than the threshold score of 20 [38, 39]. Because of this, it is more acceptable to employ Partial Least Square-Structural Equation Modeling (PLS-SEM) utilizing a non-parametric inferential technique (bootstrapping) [40]. The obtained result, 163, satisfied the PLS-SEM minimum sample size criteria (i.e., $n > 160$) [41]. Its prediction-focused approach aligns perfectly with examining how gamification factors influence continuance intention, regardless of distributional properties.

D. Model Comparisons, VIF/HTMT

The study employed Partial Least Squares Structural Equation Modeling (PLS-SEM) with 163 student responses. Bootstrapping with 5,000 resamples was used to test the structural model. Key validation metrics confirmed measurement model reliability (Cronbach's $\alpha \geq 0.70$, as shown in Table 1), convergent validity (AVE ≥ 0.523), discriminant validity (HTMT < 0.90), and no multicollinearity (VIF < 3.30). The model explained 66% of the variance in continuance intention ($R^2 = 0.66$) and demonstrated predictive relevance ($Q^2 = 0.372$). These practices were warranted to mitigate non-normal data (Mardia's kurtosis $\beta = 103 > 20$) and common method bias (Harman's single factor < 30.23% variance), consistent with PLS-SEM appropriateness for predictive, theory-testing inquiry in mandatory adoption situations such as Iraq's financially constrained educational setting.

This shows that there are no Common Method Bias problems with this study. An internal reliability test, a convergent validity test, and a discriminant validity test [36] are the initial stages in data analysis, which entails assessing the measurement model to evaluate the validity and reliability of the concept. These tests will reveal how effectively the observable variables reflected the latent

variables. When the composite reliability value is 70 or above, the internal dependability is judged sufficient [42]. Conversely, the Average Variance Extracted (AVE) threshold value for convergent validity is larger than 0.50 [43]. Finally, because of its higher performance according to [44], the Heterotrait-Monotrait ratio of correlations (HTMT) is being employed to assess discriminant validity. Below 90, the cutoff value [45] is employed for this study to establish the variables' discriminant validity.

Table 1. Cronbach's alpha (α) values for each construct derived from the pilot study

Construct	Number of Items	Source	Cronbach's Alpha (α)
Perceived Ease of Use (PEOU)	5	[15, 46]	0.818
Perceived Usefulness (PU)	5	[15]	0.760
Facilitating Conditions (FC)	5	[15]	0.713
Hedonic Motivation (HM)	4	[15]	0.707
Design Quality (DQ)	6	[45]	0.831
Intention to use Gamified eLearning (IG)	5	[46]	0.776
Total	41	Average (α)	0.770

To identify the correlations between the variables included in this study, the structural model was then evaluated. Since each set of observed variables (indicators) may be characterized as manifestations of the underlying constructs, reflective measurement models were utilized to measure all of the constructs in this study. Five phases were employed in the evaluation: (i) the lateral collinearity (VIF) [47] (ii) the path coefficients, (iii) the rate of determination (R^2) [35], (iv) the effect size (f^2) [48], and (v) the prediction accuracy (Q^2) [49–51].

IV. Result and Discussion

This part reports on the measurement model and structural model analyses based on the complete data set and preliminary data assessment done in the preceding section. In conclusion, analysis based on the original TAM was also undertaken as a comparative measure to verify the relevance of the suggested research model.

A. The Result from the Measurement Model

For the measurement model, the convergent validity may be tested based on (i) outer loading and (ii) Average Variance Extracted (AVE). An outer loading value that is high suggests that the indications most likely belong to the construct. As stated by Hair *et al.* [36], the outer loadings that should be obtained are 0.708 and above to demonstrate that the construct is competent in explaining at least 50% of the indicator's variation. In contrast, the outer loadings with a value less than .40 should be deleted [36, 43]. However, the elements with outer loadings larger than 0.40 may be acceptable if the construct has obtained 0.50 and above for the AVE score [52, 53]. In addition, some pieces were deleted owing to low loading, which is less than 0.508 [54]; whereas others were maintained since the AVE of each build is already larger than 0.50. AVE values ranged from 0.523 to 0.647, and composite reliabilities exceeded 0.70, confirming strong internal reliability and convergent validity. The internal and convergent validity findings are in Table 2.

Table 2. Convergence validity, internal reliability, and full collinearity result

Latent Variables	Items	Loadings	Random Dummy Variable VIF	Cronbach's Alpha	Composite Reliability (>0.7)	AVE (>0.5)
Perceive Ease of Use (PEOU)	PEOU1	0.884		0.843	0.901	0.703
	PEOU3	0.557				
	PEOU4	0.92				
	PEOU5	0.935				
Perceive Usefulness	PU1	0.591	1.067	0.789	0.681	0.654
	PU2	0.434				
	PU4	0.631				
	PU5	0.694				
Facilitating Condition	FC1	0.826	1.393	0.826	0.885	0.658
	FC2	0.714				
	FC3	0.869				
	FC4	0.828				
Hedonic Motivation	HM1	0.808	1.465	0.872	0.912	0.723
	HM2	0.911				
	HM3	0.901				
	HM4	0.775				
Design Quality	DQ1	0.804	1.098	0.852	0.9	0.693
	DQ2	0.862				
	DQ3	0.851				
	DQ4	0.812				
Intention to Use Gamified eLearning	ISCI1	0.718	1.192	0.888	0.923	0.75
	ISCI2	0.892				
	ISCI3	0.916				
	ISCI4	0.923				

The next assessment is connected with discriminant validity using the Heterotrait-Monotrait ratio of correlations (HTMT), given in Table 3. The HTMT values were below the cautious threshold limit of 0.90 [45], hence confirming discriminant validity. Finally, Fig. 4 illustrates the measurement model.

Table 3. HTMT results for discriminant validity assessment

Construct	DQ	FC	HM	ISCI	PEOU	PU
DQ						
FC	0.408					
HM	0.107	0.329				
ISCI	0.388	0.372	0.17			
PEOU	0.16	0.146	0.176	0.253		
PU	0.493	0.832	0.283	0.304	0.36	

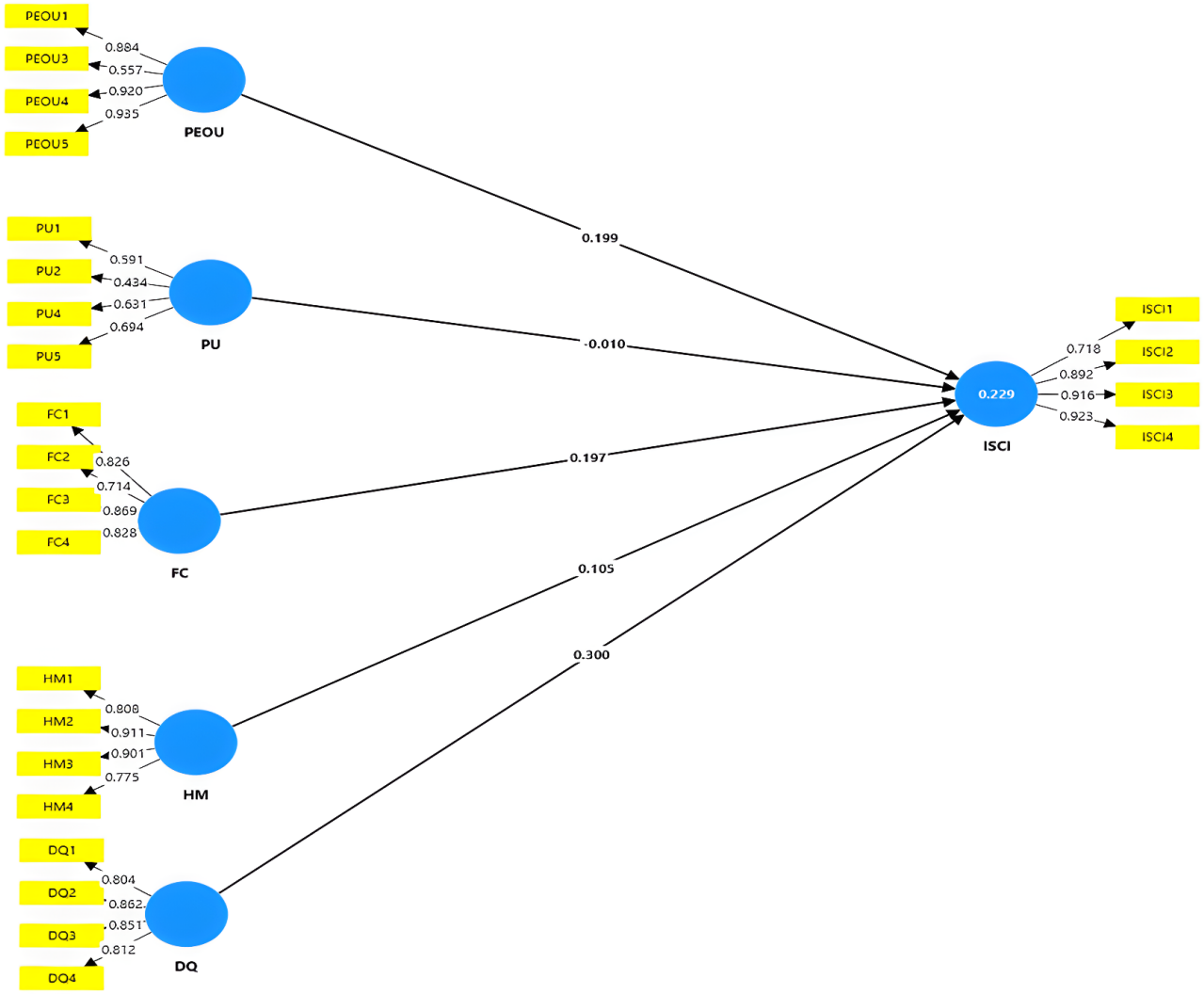

Fig. 4. Measurement model.

B. Evaluation of the Structural Model

To assess the structural model, the analysis starts by looking at the lateral collinearity (VIF) of the latent variables. Table 4 reveals that VIF values ranged between 1 to 1.192, which is lower than the cut-off score of 3 [47], showing that the multicollinearity problem is not a worry. The assumptions in the structural model were then evaluated using a bootstrap re-sample approach with 5,000 sub-samples. Fig. 5 shows the route coefficients estimated from t-statistics and R^2 of the suggested mode.

Table 4. Hypotheses testing and structural model assessment result

Hypothesis	Relationship	Std Beta	Std Error	t-value	Decision	R^2	f^2	Q^2
H1	PEOU → ISCI	0.199	0.049	4.048***	Supported	0.577	0.257	0.305
H2	PU → ISCI	–0.01	–0.099	0.101	Not Supported	0.604	1.523	0.368
H3	FC → ISCI	0.197	0.100	1.968**	Supported		0.072	
H4	HM → ISCI	0.105	0.075	1.389	Not Supported	0.66	0.104	0.372
H5	DQ → ISCI	0.3	0.083	3.572***	Supported		0.061	

Note. * $p < 0.01$, **$p \leq 0.001$; PEOU (Perceived Ease of Use); PU (Perceived Usefulness); FC (Facilitating Condition); HM (Hedonic Motivation); DQ (Design Quality); ISCU (Intention to Use Gamified eLearning); VIF (Variance Inflation Factor).

The connections between the latent variable construct and the Intention to Use Gamified eLearning (ISCI) are thoroughly investigated in light of the findings. ISCI is significantly positively impacted by Perceived Ease of Use (PEOU) (β = 0.199, t = 4.048, $p < 0.001$, 95% CI [0.123, 0.289]). This suggests that consumers are more likely to embrace gamified eLearning if the system is simple to use. Furthermore, PEOU's inner Variance Inflation Factor (VIF)

(VIF = 1.067) indicates that multicollinearity is not an issue. PEOU has significant predictive power, explaining 77.7% of the variation in the dependent variable, according to the ISCI's R^2 value of 0.577. Additionally, PEOU has a medium effect size, as shown by its 2 value of 0.257, and moderate predictive significance, as confirmed by its Q^2 value of 0.305.

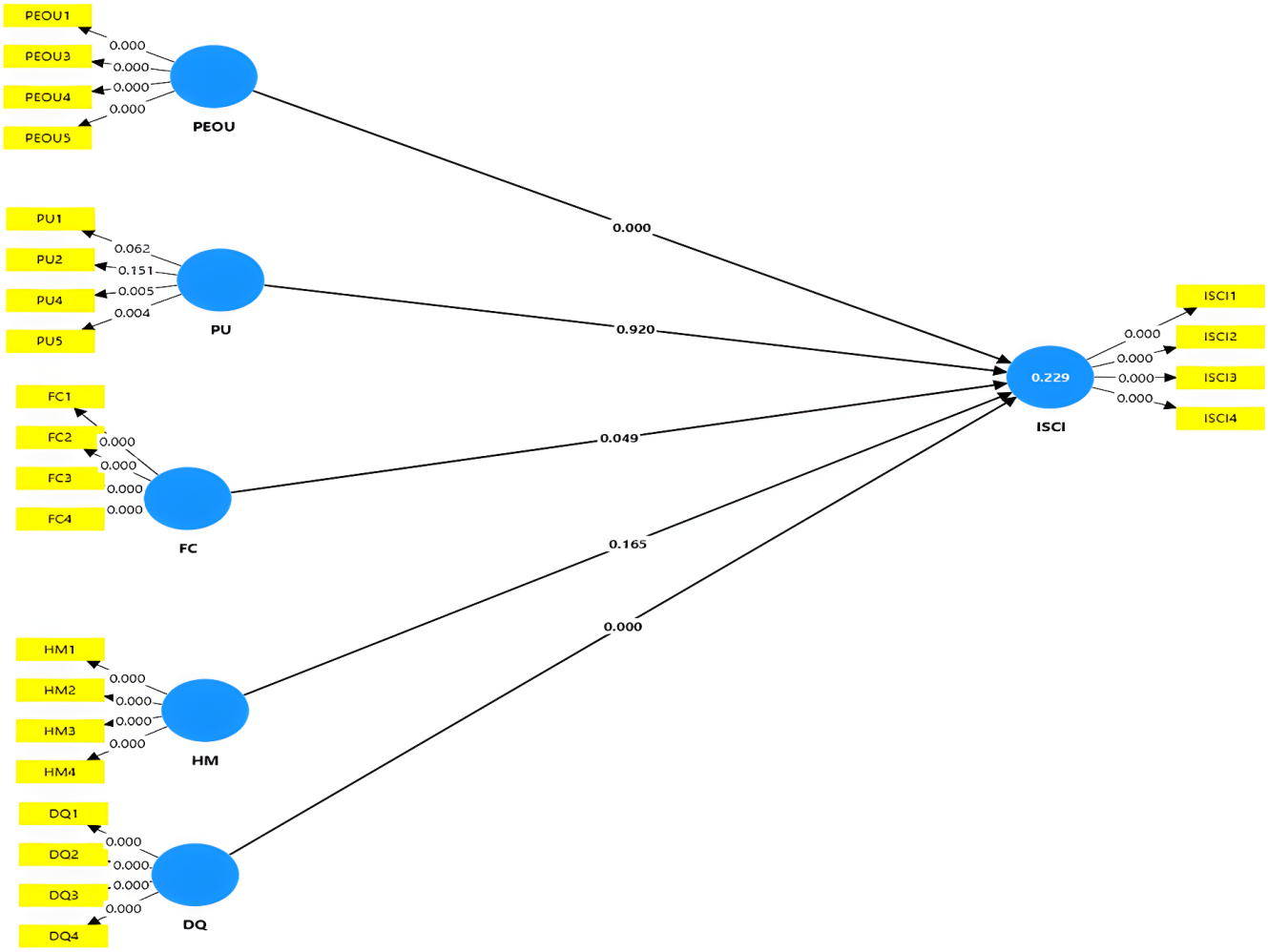

Fig. 5. Structural model path coefficient.

On the other hand, findings from PU and HM do not show any significant effect on continuance intention that explains Iraq's unique socio-cultural and infrastructural context. Societal collectivism values also undermine the competitiveness-based gamification features (i.e., leaderboards), while infrastructural limitations (e.g., bad internet) impose cognitive overload, negating HM's influence. These imperfections imply that PU and HM, being traditionally core to Western models, need to be contextually reframed in Iraq. PU ought to move towards "compliance-driven utility" (i.e., system functionalities facilitating obligation compliance) and HM towards "infrastructure-mediated enjoyment" (i.e., enjoyment arising out of functional robustness in spite of technical constraints). This might strengthen the demand for culturally adaptive gamification designs and present in detail on the Perceive Ease of Use (PEOU) and design quality in resource-scarce, compulsory adoption contexts.

Furthermore, with an R^2 value of 0.604 which explains 60.4% of the variation in ISCI, PU has significant predictive potential despite its lack of statistical significance. Furthermore, PU's 2 value of 1.523 indicates a significant impact size in its contribution to the model's prediction ability. Strong predictive importance for ISCI is shown by its Q^2 value of 0.368.

Additionally, results show that Facilitating Conditions (FC) have a strong prediction of Intention to Use Gamified eLearning (ISCI) (β = 0.197, p = 0.049, 95% CI [0.049, 0.394]), which supports the fact that institutional support (i.e., resources, technical support) increases continuance intention. The absence of multicollinearity (VIF = 1.465) and model explanatory power (R^2 = 0.66) also support this result With an SRMR value of 0.076, it demonstrates a good fit, confirming that the proposed TAM-UTAUT2 framework accurately reproduces the observed correlations among variables [55]. Although FC's practical effect size is low (f^2 = 0.072). By contrast, Hedonic Motivation (HM) displays a positive, but statistically non-significant association with ISCI (β = 0.105, p = 0.165, 95% CI [–0.113, 0.203]). While HM's effect size (f^2 = 0.104) and predictive significance (Q^2 = 0.372) suggest a potential impact, statistical non significance dissuades the conclusion about its role here. The assumption that Hedonic Motivation (HM) would play a strong role in continuance intention is supported by ambivalent evidence in similar contexts, implying that its impact is extremely sensitive to adoption conditions.

Whereas UTAUT2 situates HM at the center of voluntary technology adoption [15], compulsory eLearning studies, especially within collectivist cultures, capture mixed impacts. For example, Saleem *et al.* [56] found that gamification elements like points and leaderboards had little effect on continuance intention in Middle Eastern institutions where institutional obligation was given more importance than enjoyment since the system was obligatory to use. Similarly, Al-Mamary [22] found that Saudi Arabian learning environments with hedonic elements influenced only participation when they were combined with overt gains in performance, matching the present study's last nonsignificant finding (β = 0.105, p = 0.165). Moreover, ISCI is significantly improved by Design Quality (DQ) (β = 0.3, t = 3.572, p = 0.001, 95% CI [0.165, 0.449]). This demonstrates how important a well-thought-out gamified eLearning platform is for encouraging user intention. While the R^2 and 2 values indicate the significance of multicollinearity, the VIF for DQ (VIF = 1.192) does not. According to Hair *et al.* [35], the components together account for 66% of the variation in ISCI, which is classified as moderate based on the R^2 values. PEOU, FC, and DQ stand out among them as important predictors. The model's predictive significance is further supported by the Q^2 values, which show that all endogenous variables are greater than 0. In particular, pleasure has a moderate predictive accuracy (Q^2 = 0.35) and ISCI has a significant predictive accuracy (Q^2 = 0.372).

C. Discussion of the Result

The variables Perceived Ease of Use (PEOU), and design quality (DQ) were revealed to be the most significant determinants of higher education students' intention to continue using gamified eLearning systems. This is congruent with theoretical frameworks that highlight the role of usability and interface quality in influencing user intentions, such as the Unified Theory of Acceptance and Use of Technology (UTAUT2) [57, 58]. The PEOU underlines the significance that minimizing effort and complexity results in motivating the learner with increased adoption behavior. This research confirms the supposition that to arouse user engagement, particularly when the case concerns educational technology in which the occurrence of cognitive overload could interfere with efficient learning, the technology design has to be obvious and straightforward [59]. In the interim, DQ's strong effect supports research that emphasizes how crucial functional and visual components are to boosting user experience. In addition to enhancing the system's perceived value, well-designed systems promote long-term use by promoting efficient and enjoyable interactions [60, 61].

Contrary to previous research that identified the same factors as key predictors of technology adoption [62, 63] The study found that Perceived Usefulness (PU) is insignificant (β = –0.01, p = 0.92) on continued use contradicts some previous empirical findings such as [14, 15]. This is because, in gamified learning contexts, social influence overrides personal gains in engagement for users [64, 65]. Likewise, Iraqi higher education's obligatory adoption context may diminish PU's relevance since students use institutional systems regardless of perceived usefulness. Moreover, the operationalization of PU may have failed to detect gamification-specific usefulness (i.e., enjoyment-facilitated learning vis-à-vis conventional performance measures). Some of the recent empirical studies have suggested that PU's predictive power between technology types and cultures substantially varies [22, 66], which suggests that there should be augmented theoretical frameworks in gamification learning contexts. The statistically insignificant result ($p > 0.05$) reflects a boundary condition of TAM rather than a methodological flaw. Perceived Usefulness (PU) and Hedonic Motivation (HM) were found to have no discernible impact on the intention to use gamified eLearning systems. Gamified systems prioritize interactivity over utility, which may explain the lack of significant influence on Perceived Usefulness (PU). Gamified systems are not typical eLearning systems because they rely more on internal motivators, which are competition, challenge, and rewards, to keep the user motivated [67]. Similar, the limited role of HM suggests that while enjoyment may initially attract attention, it is not sufficient to ensure continuous usage. This challenges the assumption that gamification sustains engagement solely through enjoyment. Instead, the study points out that the entirety includes all factors, such as ensuring enjoyment as well as other important notions like usability and efficient design, to inculcate continued adoption. This subtle insight affords a far bigger role to context-specific research in capturing the multiple aspects of user behavior in gamified environments.

Though having a smaller effect size if compared to PEOU and DQ, facilitating conditions FC also appear as promising predictors for the intention to continue using gamified eLearning systems. Findings emphasize that, when talking about the stimulation of the use of technology, especially in highly technical situations, supportive environments become very important. For students to adopt and continue utilizing gamified systems, enabling variables such as reliable internet access, technical help, and institutional support are crucial [68]. The comparatively diminishing role played by Facilitating Conditions (FC) in this research could be due to heightened self-reliance among students in technology usage, a change fueled by the COVID-19 pandemic, which mandated universal adoption of eLearning [8]. As learning became more self-sufficient in handling digital resources, university support (e.g., technical help, training) could have lessened prominence for continuance intention. suggests that student's post-pandemic now assume fundamental eLearning competence as a given rather than as an influence on ongoing usage. Technology acceptance models may thus need to reassess FC's role in settings where users have already adapted to computerized learning environments.

DQ significantly influences experience and adoption intention through its dominance as a predictor in this study. Design quality, in this case, covers aesthetic appeal, functional efficiency, and user-centered design. Everything sums up to increase the perceived quality of the system [60, 67]. A more gamified eLearning system with enhanced design could attract users in a better manner, retain users over time, and make their use regular. Features such as responsive interfaces, visually beautiful layouts, and ease of navigation improve perceived value and user pleasure a lot. Well-designed systems may give users a feeling of confidence and reliability. These should be put more in perspective for the students as a way of getting them to spend

some time using the technology. The findings underline the importance of embedding design principles into the development process of gamified systems to match the expectations and preferences of the users. Given that user experience is a significant differentiator in the increasingly crowded eLearning business, this purposeful focus on design could give a competitive advantage.

The PEOU findings give another indication of how vital user-centered design is to promote the adoption of new technology. User-friendly technologies minimize cognitive stress and free up students to focus on learning goals rather than solving technical challenges [57, 59]. The apparent simplicity of use strengthens learners' assessments of the overall value of the system and boosts user enjoyment. For instance, learners who believe the system is easy to use and intuitive are much more likely to have positive attitudes toward using it. could later result in long-term engagement, emphasizing the need for iterative design methods and usability testing to ensure that gamified systems fit the expectations of different user groups. In addition, the focus on usability aligns with broader trends in educational technology, where accessibility and ease of use increasingly are major variables affecting adoption and effectiveness [58]. Thus, in the case of developing systems focused on ease of use, developers make sure that the system will operate and be usable by a much greater spectrum of students who are not highly tech-savvy. For example, if learners feel that the system is easy to use and intuitive, they are likely to develop positive attitudes toward using it. could lead to long-term engagement and place more emphasis on iterative design processes and usability testing to ensure that gamified systems meet expectations for different user groups. In other words, this study's results provide important new insights into factors driving the adoption of gamified eLearning platforms in higher education. While the minor role of PU and HM implies a need for balance between fun and functionality, the importance of PEOU and DQ brings forward a user's intention that strongly depends on usability and design.

The study recommends a design principle through the use of localized, infrastructure-resilient design. Which would be prioritized most to enhance Perceived Ease of Use (PEOU), so students with varying levels of digital literacy can use them without any technical problems. Second, localized interfaces that accommodate Arabic language, culturally familiar appearances (e.g., traditional patterns), and local examples to adapt to Iraq's collectivist pedagogy practices and reduce cognitive load. Third, offline-enabled features (e.g., downloadable resources, low-bandwidth capability) must neutralize infrastructural disadvantages like unstable internet to ensure smooth access in low-resource situations. in addition, cooperative gamification mechanics—group challenges and group rewards—need to replace competitive elements like leaderboards, aligning with cultural orientations towards communal learning instead of individual competition. These guidelines, drawing on the research's findings regarding the high predictiveness of DQ, are designed to fill gaps in usability, cultural compatibility, and technical constraints so that gamified systems are both functional and contextually relevant to Iraqi students.

D. Contributions

This study advances gamified eLearning scholarship by combining TAM and UTAUT2, but additionally in the context of f Iraq's unique learning environment would make it a more theoretically impactful study. As Venkatesh *et al.* [69] highlights the power of these variables differs across types of products and implementation contexts and also because of demographic or cultural differences. That unique insight calls on researchers to have a more in-depth approach to the application of TAM within diverse educational settings. This further complements the existing studies, for example, those by Park and Kim [70], Chen *et al.* [71], that mainly focused on direct linkages without studying the intermediate mechanisms. In terms of managerial contributions, this study presents practical advice for HEI academic development teams. The findings may be exploited by these teams, which often include designers, product developers, and decision-makers, to improve gamified eLearning systems.

In Iraq, mandatory adoption of institutional eLearning platforms decreased Perceived Usefulness (PU) because students had no option, and collectivist cultural norms—while unmeasured—would have implicitly affected acceptance behavior. Iraq's infrastructure constraints (e.g., subpar internet) make enabling conditions especially crucial compared to developed nations, and the prevalence of traditional lecture-based pedagogy might be the reason why design quality was more influential than hedonic motivation. These situational factors do not merely limit generalizability; they demonstrate how crisis-driven digital transformations (post-COVID), and centralized education systems fundamentally transform technology acceptance dynamics. Overtly declaring Iraq's instructor-led, resource-constrained environment to be a boundary condition for Western-based models would place this research in the model position for other emergent education environments. It justifies the activation of the psychological expectations of function-based perceptions of learners, which eventually helps to satisfy learners' functional needs and creates a desired learning environment. It also highlighted the need for developers to enhance the usability and usefulness of the gamified eLearning systems. Some of the major themes include cross-platform compatibility, increasing user-friendliness, and providing adjustable features that can be adjusted to fit a range of student preferences. Previous research [72, 73] flags the importance of favorable circumstances in deciding on technology adoption, even though our study showed them to be minor.

E. Limitations and Future Research Directions

This is subject to three key limitations. First, since it is a cross-sectional correlational study, it falls short of capturing dynamic changes in the perceptions and behaviors of learners. Second, it would very well be served by longitudinal designs that show a clearer picture of how the perceptions of ease of use and usefulness evolve to impact long-term usage intentions. Third limitation comes from the sampling of only specific programs meant that other academic fields, including humanities, arts, and education, were not included. The sample size was also relatively small and limited to generalizability.

Therefore, future studies should include various disciplines in academics to make the results on acceptance of eLearning systems more holistic in understanding. Having a larger, sample size can give more diverse samples across multiple studies to validate the results and provide more robust insights. Future studies should also investigate how gamification design elements, such as mechanics and interface features, affect learners' engagement and motivation. may lead to the development of more effective gamified eLearning applications for specific educational needs. Institutional leaders need to organize workshops on technology transfer that will train educators on gamified teaching strategies for effective implementation. Such workshops could also provide guides on how best to integrate the technologies into the learning activities to reap the maximum benefits of the gamified eLearning tools. Lastly, concerning potential future disruptions such as the COVID-19 pandemic, faculties must invest in the creation of resilient and interactive eLearning systems capable of keeping learners motivated and involved during online learning processes.

V. Conclusion

The COVID-19 pandemic highlighted the vital importance of technology in ensuring the continuity of education during periods of disruption. Digital tools enabled students to access learning materials online and engage in real-time, interactive communication with their peers and instructors, thus showing the importance of digital approaches in maintaining connectivity in education. With the world now moving on to the post-pandemic era, the question of learners' willingness to continue using the digital learning tools they relied on during the pandemic has come up. Continuance use intention is therefore an important concept to be researched for encouraging knowledge acquisition among students and retaining users for educational platforms. This research helps to serve that discourse by setting out and empirically assessing an integrated theoretical framework of the continued use of a gamified eLearning application through integrating TAM with UTAUT2. The findings have highlighted the significant role that these pre-acceptance explanatory variables' perceived usefulness and ease of use play in shaping learners' continuance intentions toward the gamified eLearning application. However, it is observed that facilitating conditions, as emphasized in the previous studies, were less effective here due to the special situation facing the pandemic of COVID-19 in Iraq, where teaching and learning activity was conducted fully online. The students were constrained from socializing with peers and teachers and thus had to self-manage their conditions to facilitate their learning. Determinants of continuance use intention in this study can provide practical insights for developers and stakeholders to enhance gamified eLearning resources. Well-designed gamified applications can meet learners' evolving needs by combining engaging design with robust functionality. More than serving as a medium for technology, eLearning applications are essential to make interaction between educators and learners seamless and efficient in comparison to other eLearning resources. The study positions gamified eLearning applications as tools that modern education cannot do without. Their flexibility, convenience, and interactivity give learners the ability to constantly interact with academic content, bringing them closer to educational institutions. This is what makes investing in the improvement of gamified eLearning applications beneficial and indispensable while creating a dynamic and inclusive environment for learning because of growing demands by a rapidly digitizing educational landscape. It will open further research and practice, allowing the gamified eLearning process to remain well entrenched as an integral part of the education innovation system.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

R. T. A. is a Ph.D. student who designed and conducted the research, analyzed the results, and wrote the manuscript, holding all responsibilities related to it as the corresponding author. The supervisors, N. A. A. and N. L. A., reviewed the work and made the necessary corrections. All authors have read and approved the manuscript for submission. All authors had approved the final version.

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