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Students' Educational Game Acceptance in Higher Education in Saudi Arabia

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Abstract **- Studies on educational games (EG) have shown growing interest among researchers due to the potential and preferences of the younger generation. Games technology is among the most popular forms of technology nowadays with billions of transactions yearly. Compared to traditional learning, games have features to provide opportunities for more enjoyable and engaging learning. Despite their great potentials, studies done among researchers on educational-game acceptance among students and teachers are still limited. This is due to challenges to design EG that is well-balanced between fun and learning features. Therefore, it is important to explore factors that contribute to the acceptance of EG. Despite many studies done on EG acceptance, most have only focused on the acceptance factors but not on the game features themselves. Thus, this study fills the gap by integrating the game-design factors, namely feedback, challenges, goals, and rewards, into the Extended Technology Acceptance Model (TAM) that contains 10 constructs and 66 items. A quantitative study among 300 survey participants has been administered at Taif University in Saudi Arabia. Data have been analysed using the structural equation modeling by utilising the PLS-SEM tool. Findings show that game-design features, which are challenges, goals, and rewards, are significant on perceived ease of use, while feedback and challenges are significant on perceived usefulness. Features, goals, challenges, and rewards have a significant effect on perceived usefulness, while intention to use educational games is influenced by learning content, enjoyment, and perceived usefulness. In conclusion, several game-design features are important to be incorporated into EG to ensure the presence of its fun elements while not compromising the learning features. Therefore, educational-game designers and developers should integrate these factors in game design and development in order to increase student engagement and acceptance of educational games.**

Index Terms **- Computer-based, educational games, games design features, students, technology acceptance model.**

INTRODUCTION

Educational games (EG) are regarded as the new and innovative teaching-and-learning medium for the younger generation. The popularity of game-based learning provides wide opportunities for students to gain specific information and knowledge to improve teaching approaches and learning outcomes [1][2].

Besides, incorporating digital games into classrooms also helps students to become more tech-savvy and keep up with the digital age. The advancement of technologies and devices, such as the Internet, computers, tablets, and smartphones, especially in transferability and delivering various educational content, has helped in igniting attention and attraction to digital games [3][4]. Educational games have been shown to aid the learning process by increasing students' interest and motivation in learning [6]. The instructional technologies are also able to provide elements that improve problem-solving skills, creativity and social skills [2][5][6].

Despite positive and promising findings of educational games, the level of acceptance among teachers and students is still low. This is due to several issues, such as the adaptation of learning content or syllabus into the games apart from implementation issues [7]. Learning-content design can be a major issue due to its complexity and comprehensiveness in addition to game-design issues. Blending these two major components is highly challenging due to the complexity of both parts. This study extends the learning content and game-design parts into the original TAM model to test how these relationships are perceived by students. With the advancement of technology and preferences of our younger generations towards computer and mobile technology, it is important to conduct a thorough study on factors that contribute to the acceptance of educational games. This is to ensure that in-depth understanding and knowledge are available to assist instructors and educational administrators with regards to using games technology at school.

COMPREHENSIVE THEORETICAL BASIS

I. Technology Acceptance Model (TAM)

TAM is a well-known research model used to predict how an individual will accept new technologies [8]. TAM's two main elements, namely perceived usefulness (PU) and perceived ease of use (PEoU), are significant in determining users' intentions to adopt new technologies (Figure 1). Since its inception, TAM has incorporated new and modified variables into the original model.

Despite TAM's strengths, other determinants, such as perceived entertainment value and perceived presentation attractiveness, playfulness, experience, self-efficacy, perceived risk, and social influence, were found to contribute to the use of information technology [9]. These variables are identified as influencing behavioural intention and attitude towards the use of EG.

Other theories, such as the Theory of Planned Behaviour (TPB) [10] and the Unified Theory of Acceptance and Use of Technology (UTAUT) [11], have evolved from TAM. These theories have been used in healthcare, finance, telemedicine, and education. Scherer et al. in [9] asserted that TAM could predict user behaviour, especially for those new to technology. TAM is also robust and parsimonious even though the model had been established a while ago and several new models emerged afterwards [12]. Thus, TAM was chosen to support this study's proposal of a new framework for university students' acceptance of EG. Despite many studies being done on students' acceptance of educational games, most studies have focused on acceptance features only and paid not much attention to game-design features and learning content [13]. Thus, the game-design features were integrated into this study as an external factor that influences students' acceptance of educational games in higher education.

a. Perceived Usefulness (PU)

TAM characterises PU as a factor that signifies "the degree to which a person believes that using a particular system will improve individual job performance" [8]. Several prior studies had shown significant impact of PU on students' intention to use EG [3][14][15]. Thus, PU is closely linked to the use of technology to aid people to achieve effective and productive job performance. In addition, individual attitudes could also predict behavioural intention to use technology. Thus, this study used PU to assess higher-education students' acceptance and behavioural intention of EG.

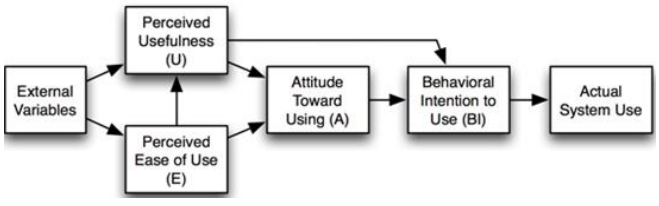

Figure 1 Technology Acceptance Model [7]

b. Perceived Ease of Use (PEoU)

[8] defined PEoU as "the degree to which a person believes using a particular system would be free of effort". In short, PEoU occurs when users perceive technology as simple and easy to use. For example, when academics realise that teaching with technology is easy, they will not hesitate to adopt it. However, complex technologies would not be appealing to academics because they would need to learn how to use the technology seamlessly to ensure successful integration in classroom [16].

PEoU's emphasis on TAM accentuates the fact that users do not have to exert extra effort to adopt new technologies [17]. In this sense, students' acceptance of EG is dependent on their perceptions of the ease of use of technology. Thus, PEoU was used in this study to assess higher-education students' acceptance and behavioural intentions towards EG.

c. Beliefs, Attitude, and Behavioral Intention

Beliefs (e.g., PU and PEoU) have influenced attitude and behavioural intention, according to [8]. In a study, both PU and PEoU were considered game-design factors that lead to behavioural intention followed eventually by actual system use [15]. Based on Figure 1, TAM depicts users' first impressions or beliefs towards EG systems. The perception of individuals on the usefulness of a new technology as well as the ease related to the use can affect their attitude and intention to use. When the individuals recognise that the system would be effortless (PEoU factor), it will eventually lead them to the use of that system. Consequently, the PU factor occurs when the players' performance is improved by PEoU. The users will then be tempted to intentionally use EG. Some research which used TAM as the basis of their EG acceptance model excluded the attitude and actual system use factor and investigated the relationship between PU, PEoU and behavioural intention only [7][15].

II. Computer-Game Design Features

Instructions, goals, rules, edutainment, interactivity, multisensory, and motivational traits are defined as key game-design features. In essence, digital games must include features that improve learning and engagement. Interestingly, it was stated that using digital games in lessons has increased significantly, with 55% of educators using them weekly and 23% daily. The increase in usage has prompted more research into individual games' efficacy and which game-design features that could help enhancing behavioural intention in learning [18]. While digital-game design features are a significant attribute [4], feedback, challenging tasks, goals, and rewards are also important added attributes [19]. These elements help students to learn better by scaffolding learning to support student engagement. Crucially, a game design determines its success. Although the game design has been proven to be effective in a learning environment, [20] emphasised the importance of the design process in achieving a perfect balance of educational and entertainment elements.

With regards to TAM in this study's proposed framework, four contexts were discussed, which are feedback, challenges, goals, and rewards, to be integrated into game-design features as the external variables.

a. Feedback

Feedback is an element that provides information on students' progress and is of importance to students' motivation [21]. Constructive, just-in-time feedback should be available to players.

It is because EG provides immediate feedback and the players' concentration is encouraged while playing. Additionally, immediate feedback also helps the players to track down their objectives, progress, and achievements [22]. Besides, regular feedback also allows them to keep track of their progress [23]. [24] stated that immediate feedback keeps players in a zone of proximal development and balances their feelings of challenge and frustration as they complete the game. Apart from that, the players can also use feedback to reflect their performance and improve [25]. Thus, while features, such as game scores, may allow the players to figure out their relative positions, constructive feedback allows for game empowerment.

Meanwhile, the game's interface and audio can also provide feedback based on the players' progress, allowing them to adjust the game's difficulty levels to their skill levels. Giving the players clear and appropriate feedback based on their abilities can help educators to monitor their students based on the game's predetermined academic objectives [19]. Feedback and interaction are also interrelated [26]. This interaction identifies human association, simulation gaming equipment, and game characters [4]. During the gaming process, feedback from game providers allows students to reflect their learning, build appropriate schemata, and assess their performance.

b. Challenges

In games, challenge is defined as an element that allows players to reflect their experiences while playing [25]. In digital games, challenges are pre-set tasks of varying difficulties that require a certain amount of effort to complete [26]. Individuals may interpret challenges differently and categorise them based on their complexity. Exertion is a recognised form of challenge in EG. Challenges are commonplace in players' quests to achieve goals [24]. Exertion occurs when a game's design and features rely on players' physical responses as the core of the experience, and interacting with technology requires physical activities. [27] demonstrated that challenging games could either motivate, entertain, or discourage users, depending on whether they have achieved the objective or not. Thus, games with appropriate challenges and goals can help students to stay engaged in learning.

Featuring different levels of difficulty in games are important because it lets players to know the levels that challenge them and how much effort is required to succeed. To illustrate, [19] reported that increasing games' levels of difficulty would allow students to use their current skills or choose a level they are comfortable with while ensuring that the challenges spark their curiosity and engagement in learning.

c. Goals

The importance of clearly stated goals and instructions in game design was noted by [28]. Goals are defined as elements that provide players with a relevant game experience.

In EG, they help to determine whether the game's design and features have helped players to meet learning objectives [29]. In addition, goals in EG may help the players to become aware of individual goals [30]. Although goals are narratively linked, objectives and game rules bear similar traits. Objectives in varying gaming levels engage and motivate students to continue playing. Hence, to increase player engagement, game designers must include multiple levels of objectives in a game's storyline.

For example, a game can be programmed to engross players by gathering enchanted keys, then lead them to opening a 'magically locked safe', which consequently 'saves the world'. This approach of engagement keeps the players focused on the game being played until the goals are achieved. Based on research, games should have objectives that educators and students can use to assess their progress. Games could include traits-related objectives like badges, tools, or riddles [19]. For instance, there is a depiction of code red in a game where players are tasked to perform triages [31].

d. Rewards

Reward in gaming is defined as a motivator and tool provided by EG to encourage player engagement [19]. Players are intrinsically rewarded to symbolise accomplishment by finishing each game level, which is designed to meet specific user effort, mastery, and progress [32]. Similarly, negative rewards are a form of reinforcement in that it adds a discipline element to the game, which is beneficial to the learning process. The use of rewards in online EG increases student engagement and, thus, passion for learning [33]. Hence, reward creates certainty prompting individual fulfilment in the learning process.

III. Educational-Game Design Features

Educational game is defined as a computer programme that supports graphics, entertaining scenes, and enhanced player interaction. Students today are digital learners who are profoundly formulated, organised, intuitive, and social, which lead to the exponential interest in EG by instructors. [27] stated that the popularity of the game-based learning model (GBL) is due to a game's features that allow learners to play and learn simultaneously [28]. In addition, EG appears to be more applicable for computer-programming degrees as their appealing graphics, intriguing situations, and high intuitiveness encourage students to learn computer-

programming concepts by completing objectives within a domain they are already familiar with [34].

However, when played for entertainment purposes only, these games have their disadvantages, for such a purpose may hinder achieving learning goals. Thus, the games must be designed to be both entertaining and educational. It is necessary to address educational-game design features to address technology complexities, such as low enthusiasm, complicated programming features, and inadequate scaffolding of learning.

Three TAM elements will be discussed, namely enjoyment, learning opportunities, and learning content, which are similar to the function of PU and PEoU, and contribute to the proposed framework.

a. Enjoyment

The gaming industry expects game designers to create tangible games that give players enjoyment as well as fulfilment [30]. As a result, hedonic and utilitarian dual-system games have been created. Hedonic is defined as indulgence in entertaining or luxurious activities [14], whereas utilitarian is engagement in important and practical activities or events. In this study, playing EG is a hedonistic activity that triggers pleasure and enjoyment. [30] found that one of the factors attracting students to EG is enjoyment. Enjoyment is defined as the extent to which activities involving EG create a sense of fun [7][35].

Earlier researchers studied the effects of graphics, active collaboration, self-improvement, and varying levels of difficulty on enjoyment in EG. These game-design features ensure students' behavioural intention to use games and their effects on their learning capabilities. In a utilitarian setting, playing EG is considered productive and part of learning [36]. [11] suggested that, among other reasons, people play computer games for enjoyment. In addition, [37] discovered that playing computer games teaches players computer-programming while researching the effects of enjoyment in EG. Moreover, [38] investigated questions about an educational game's enjoyable aspects, of which appropriate responses have reflected the game's serious nature and how it has aided learning. Researchers proposed that perceived playfulness or enjoyment may influence behavioural intention to use hedonic systems and have a notable effect on players' intention to play [11]. Therefore, incorporating enjoyment into an acceptance model is important in understanding user-related factors. Thus, this study suggested enjoyment as a predictor of user intention to use information systems.

b. Learning Opportunities

Learning opportunities refer to how much students believe using video games in classroom can offer them opportunities to learn [7]. It may be contended that this is fairly prohibitive for learning since it is mainly centred on results. However, it is widely believed that training goes beyond negligible results [39]. Using gaming features in an educational context allows students to actively participate in the learning process, and for lessons to be carried out on a digital platform, players would be more motivated, attentive, and retaining knowledge longer. Thus, the learning process must be considered as a constructed learning opportunity that represents the way towards learning.

Due to early exposure and engagement with technology as they are growing up in the digital age, this new generation of students is identified as digital natives. Because the students are more tech-savvy today, their learning styles differ from those who have been from earlier generations as they prefer learning objects that address their evolving attitudes and allow collaboration, basic reasoning, control, and experimentation.

c. Learning Content

Learning content is referred to as the educational content that relates to a specific subject adapted into a game. EG should have learning content that matches the gameplay and specific learning outcomes and objectives. It was discovered that game content plays a role in enhancing students' acceptance and motivation to play a specific game [40]. Furthermore, game content must also be in line with the curriculum as the students must master skills listed in the learning outcomes while using technology in their learning. As such, game designers and developers must incorporate curricular assessments and plan how to accommodate the students with varying learning needs. To illustrate the importance of learning content, by incorporating problem-based and experiential-based learning, EG allows the students to learn incidentally while acquiring skills, information, and behaviour.

METHODOLOGY

I. Proposed Framework

The proposed framework of this study is an extension of TAM based on game-design features and learning opportunities. Concerning the list of hypotheses, this study investigated the extent to which game-design features influence how students perceive usefulness and ease of use. This dimension is used to identify individuals' behavioural intentions towards EG. It is further noted that the influence of enjoyment, learning opportunities, and learning content is also determined by students' behavioural intentions that affect their acceptance of educational games. Games features consist of feedback, challenges, goals, and rewards derived from the studies related to games. These variables are the representatives of choices that influence students' behavioural intention towards EG. The proposed framework showcases the development of the relationships and effects linked to the TAM Model as shown in Figure 2.

II. Testing of the Hypotheses

The development of the fourteen hypotheses in this research, based on the TAM model and related game-design features is meant to examine whether the external variables affect students' behavioural intention to use EG.

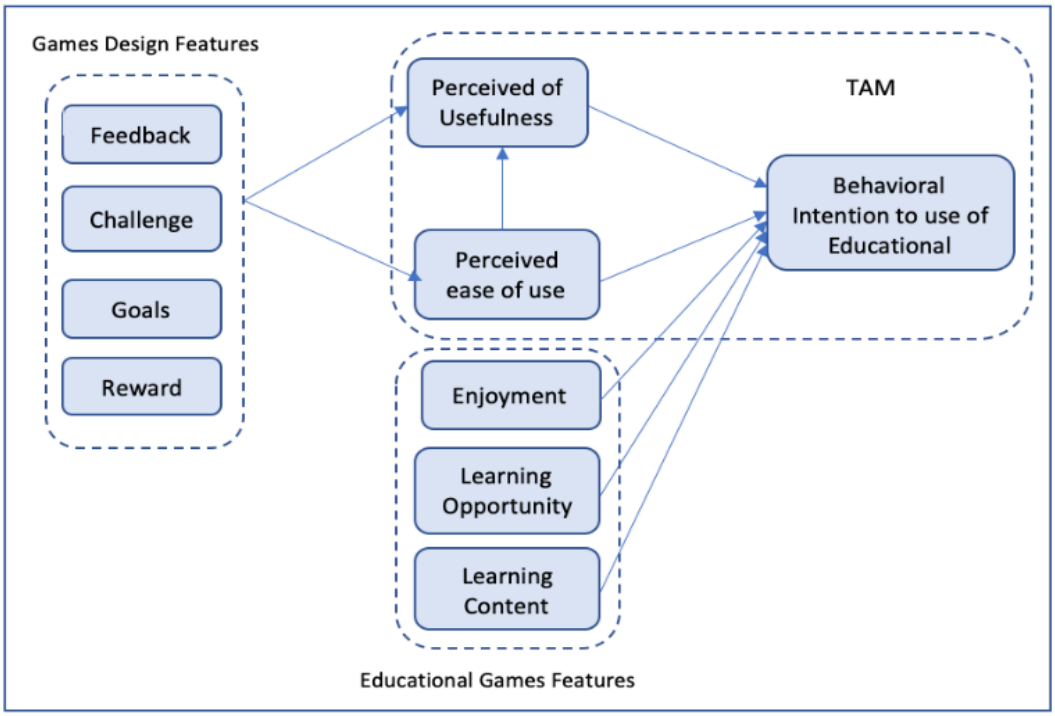

Figure 2 Proposed Research Framework

The first set of hypotheses proposes that there is a significant relationship between game-design features and perceived usefulness, as follows:

H1: There is a significant relationship between Feedback and Perceived Usefulness.

H2: There is a significant relationship between Challenges and Perceived Usefulness.

H3: There is a significant relationship between Goals and Perceived Usefulness.

H4: There is a significant relationship between Rewards and Perceived Usefulness.

Various studies discussed the link between game-design features and perceived usefulness. [41] believed that game design is crucial in determining perceived usefulness. [42] discovered that the level of acceptance in using the game is not due to effort expectancy, but rather students' perceived usefulness and how they interact with their peers. Students recognise the value of exposure to technology in their future careers and believe that the game is a form of exposure. These findings are in line with [4], who claimed that perceived usefulness is one of the key determinants of learners' satisfaction with the game and its efficacy in aiding learning. Their research revealed that the game's features allow undergraduate students to set goals and the user-friendly instrument allows them to stay focused on the learning content and actively engaged in the learning process.

Meanwhile, the second set of hypotheses proposes that there is a significant relationship between different game-design features and perceived ease of use, as follows:

H5: There is a significant relationship between Feedback and Perceived Ease of Use.

H6: There is a significant relationship between Challenges and Perceived Ease of Use.

H7: There is a significant relationship between Goals and Perceived Ease of Use.

H8: There is a significant relationship between Rewards and Perceived Ease of Use.

[43] explained that game design and functionality have a significant impact on user experience. They made a game to teach colour-mixing in their research. The game allowed students to mix colours independently, and they thought that it was easy to use and helped them to learn colour combinations. These findings supported the importance of game design for ease of use as noted by [41]. The significant link between game-design features and perceived ease of use was also discussed by [43] as the emphasised was on importance of ensuring that game design is suitable for the intended users, as games that meet users' skill levels would be more appealing and user-friendly.

In the interim, the third set of hypotheses investigates whether there is a significant relationship between PU, PEoU, and behavioural intention to use:

H9: There is a significant relationship between Perceived Usefulness and Behavioural Intention to Use.

H10: There is a significant relationship between Perceived Ease to Use and Behavioural Intention to Use.

H11: There is a significant relationship between Perceived Ease to Use and Perceived usefulness.

One study claimed that user intent to use is influenced by the updated designs of material objects or services. On top of that, another study also believed that game design could influence users' perception of the application as well as their intention to use the games [43]. Concerning confidence, [44] indicated that confidence affects an individual's intentions due to its impact on ease of use and usefulness. [20] reported that perceptions of a multimedia application as relevant and significant increase users' intent to use it. Their findings matched those of which found that perceived usefulness both directly and indirectly influences teachers' intentions to use educational multimedia games. [43] confirmed the significance of perceived ease of use in influencing users' intent to use multimedia-related applications, while [44] confirmed the link between perceived ease of use and behavioural intention to use.

The fourth and final set of hypotheses investigates whether there is a significant relationship between behavioural intention, enjoyment, learning opportunities, and learning content:

H12: There is a significant relationship between Enjoyment and Behavioural Intention.

H13: There is a significant relationship between Learning Opportunities and Behavioural Intention.

H14: There is a significant relationship between Learning Content and Behavioural Intention.

[20] affirmed that intention to use is linked to a user's enjoyment in the use of technological-related applications. Both [12] and [44] agreed that enjoyment is a factor that encourages users to use a technology. Another study also found that learners who have autonomy over when and where they learn are more likely to use multimedia learning platforms.

Concerning learning content and behavioural intention, [45] investigated the factors that could influence instructors' intentions to use learning management systems (LMS). Findings show that intentions to use LMS by instructors are related to perceived usefulness, ease of use, and task-technology fit. Thus, their decisions to use technology-related applications are based on the applications' suitability and relevance to their responsibilities.

III. Participants and Recruitment Procedures

A quantitative approach was used to survey the undergraduate students studying programming at Taif University in Saudi Arabia. A total of 500 students were contacted, of which 300 took part in the survey. 290 responses were used – 118 male respondents (41%) and 172 female respondents (59%) – after eliminating the incomplete responses. It was found that the participants' age ranges between 18 and 26 years old. Their course progression is tabulated as Year 1: 123 respondents (42%), Year 2: 130 respondents (45%), and Year 3: 37 respondents (13%).

These students were enrolled in three different majors, which are: Information Technology 115 respondents (40%), Computer Science 93 respondents (32%) and Computer Engineering 82 respondents (28%). They were asked to use online educational games for learning programming, named Code combat (codecombat.com), for the data-collection procedure.

IV. Instruments

The questionnaire was divided into two sections; the first section examined demographic data, such as gender, age, department, years of study at Taif University, semester grade, and game-playing habits. Meanwhile, the second section examined the factors of educational-games acceptance in detail and was divided into the multiple sub-sections with the items assessing perceived usefulness, ease of use, enjoyment, learning opportunities, rewards, challenges, goals, feedback, learning content, and students' intention to use EG.

V. Analysis Strategy

The Partial Least Squares Structural Equation Modelling (PLS-SEM) (Version 3.0) software was used to test the research model and understand the simultaneous modelling of relationships among the various independent and dependent variables [46]. PLS algorithm calculation provided path coefficients (along the arrows), which described the relationships between the constructs for a structural model shown in Figure 3. The scales' internal consistency was analysed based on the reliability analysis of the respondents (n=290). All the scales were found to have high internal reliability, with Cronbach's Alpha coefficients exceeding the threshold [47]. All the constructs of this research model are positively reflective indicators to observe the effects of the latent variables. Internal consistency and discriminant validity were assessed by using Cronbach's Alpha (CA) and it was found that the loading of each variable exceeds the recommended value of 0.7 and is significant at a p-value < 0.05. The ten constructs in this study have convergent validity, with all loadings greater than 0.50 and maximum loadings exceeding 0.60. The factor loadings range between 0.655-0.939. The items with a loading less than 0.70 could still be considered significant, but a higher variance in measures is attributed to error.

The high factor loadings suggest that the measures have convergent validity. All the factor loading constructs exceed the AVE cut-off (0.50) as shown in Figure 4. The evaluation of discriminate validity was performed and each item's cross-loading in the constructs was examined. Meanwhile, the AVE square root was also calculated. It is imperative that the items' loadings are higher in their relevant constructs in comparison to the remaining constructs. The observed AVE square root factor should be higher than the remaining correlations between the constructs. Figure 4 shows the reliability and validity results.

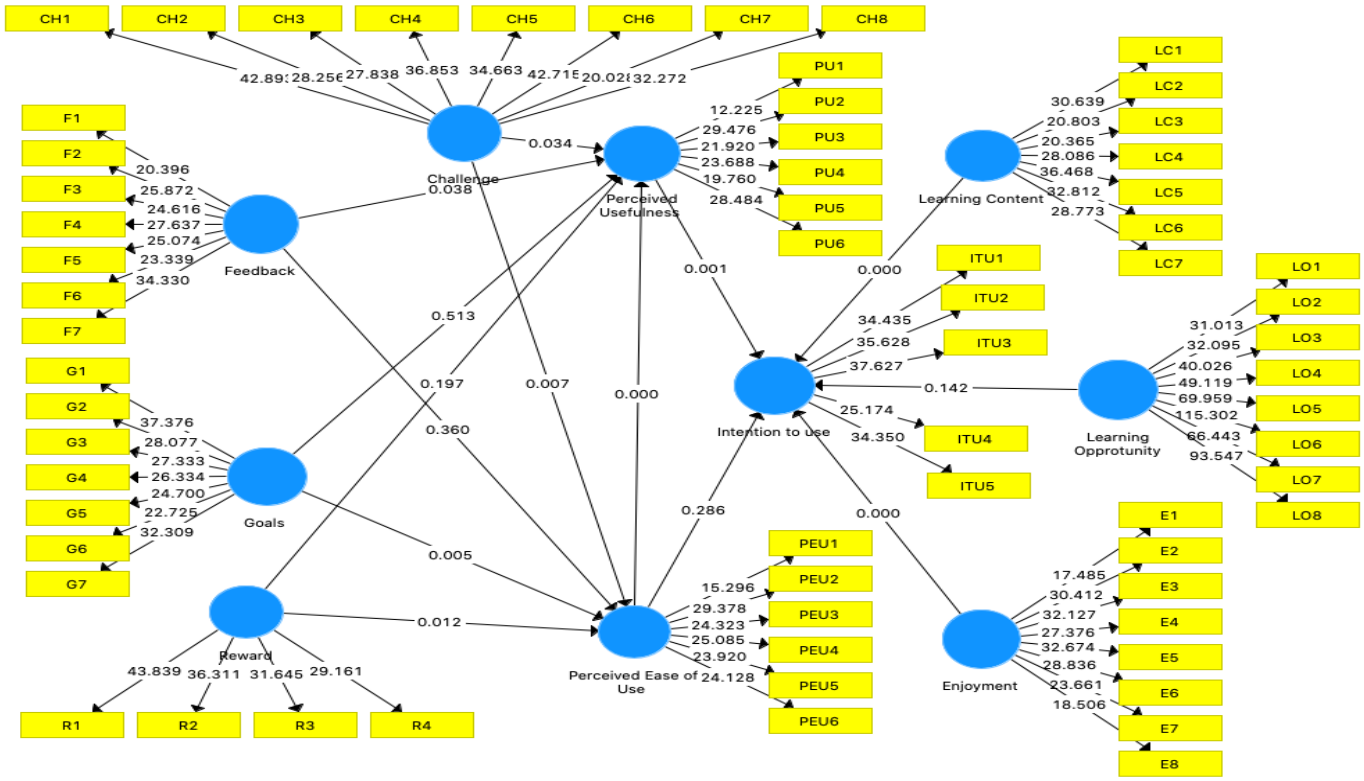

Figure 3 Structural Model

	CA	CR	AVE	CH	E	F	G	ITU	LC	LO	PEU	PU	R
CH	0.926	0.939	0.659	**0.812**									
E	0.894	0.915	0.575	-0.374	**0.758**								
F	0.895	0.918	0.614	-0.387	0.733	**0.784**							
G	0.906	0.926	0.640	0.74	-0.375	-0.434	**0.800**						
INU	0.873	0.908	0.664	-0.561	0.688	0.793	-0.508	**0.815**					
LC	0.894	0.917	0.611	-0.396	0.708	0.879	-0.434	0.773	**0.782**				
LO	0.969	0.973	0.821	-0.497	0.514	0.527	-0.464	0.469	0.513	**0.906**			
PEoU	0.846	0.887	0.566	0.663	-0.301	-0.374	0.66	-0.452	-0.388	-0.478	**0.753**		
PU	0.846	0.886	0.566	0.622	-0.31	-0.424	0.593	-0.506	-0.402	-0.456	0.695	**0.752**	
R	0.853	0.901	0.695	0.765	-0.424	-0.448	0.721	-0.528	-0.415	-0.463	0.65	0.604	**0.833**

Figure 4 Reliability And Validity Results

RESULTS AND DISCUSSION

I. Analysis

In the proposed framework, the researchers developed several hypotheses to examine the relationship between game-design features (feedback, challenges, goals, and rewards) and perceived use and ease of use. Table I presents the results and shows that nine out of fourteen paths, represented in boldfaced, have significant relationships, with p-values < 0.05. Similarly, four paths show no significant relationships, with p-values > 0.05, and T-statistic values above 1.96 being significant at the 0.05 level.

The findings suggest that the proposed framework showcases EG's acceptance among the Saudi undergraduate students in the public universities.

Challenges is the strongest design feature for student acceptance of EG. The findings show that the students' desire to play EG was caused by the games' challenges, which motivated them to apply a certain level of effort and desire to accomplish a goal. The findings are consistent with the previous studies, which claimed that games are complemented by challenges between processes in achieving goals and inducing exertion. Perplexing games can inspire, amuse, or discourage players when they succeed or fail.

TABLE I
HYPOTHESES ON THE RELATIONSHIP BETWEEN THE VARIABLES

Hypothesis	T-Statistic	P-value	Results
Feedback → Perceived Ease of Use	0.916	0.360	Rejected
Feedback → Perceived Usefulness	2.087	0.038	Accepted
Challenges → Perceived Ease of Use	2.712	0.007	Accepted
Challenges → Perceived Usefulness	2.128	0.034	Accepted
Goals → Perceived Ease of Use	2.837	0.005	Accepted
Goals → Perceived Usefulness	0.655	0.513	Rejected
Rewards → Perceived Ease of Use	2.519	0.012	Accepted
Rewards → Perceived Usefulness	1.293	0.197	Rejected
Perceived Usefulness → Intention to Use	3.462	0.001	Accepted
Perceived Ease of Use → Intention to Use	1.069	0.286	Rejected
Perceived Ease of Use → Perceived Usefulness	5.419	0.000	Accepted
Enjoyment → Intention to Use	3.724	0.000	Accepted
Learning Opportunities → Intention to Use	1.425	0.155	Rejected
Learning Content → Intention to Use	6.562	0.000	Accepted

However, other game-design features, such as feedback, goals, and rewards do not affect behavioural intention to use EG. Prior research noted that PU and PEoU, as the external elements, initiate behavioural intention and attitude to use, eventually leading to actual system use [8]. However, the effect is more noticeable in PU because the students perceived PEoU as ineffective in encouraging them during the educational game as they were more motivated by the satisfaction of solving this challenging game. The students accepted the fact that EG is fun and relevant. However, educational-game developers and universities should understand game-design features and how PU influences students' acceptance and use of EG. The strongest proposed element for student acceptance of EG whose functions are similar to PU and PEoU is learning content. The importance of learning content in acceptance is consistent with [18], who included scaffolding mechanisms as a learning-content feature. Learning content is unique in a sense that it provides mechanisms to enhance student engagement. Likewise, the learning content of a game and its activities should also be supported by learning objectives and outcomes.

II. Theoretical Implications

The researchers found support for the theoretical notion that TAM could be a generalisable game-design-feature construct incorporating the external variables like feedback, challenges, goals, and rewards towards behavioural intention in an educational-game environment. This study proved that the game-design-feature construct is credible in an educational setting. This is because the game-design-feature construct is a new trend in research on student participation [26]. In conjunction with TAM, this construct is still lacking as correlations between the proposed external variables are rarely discussed.

III. Practical Implications

Based on the findings, educational-game developers can take into consideration integrating acceptance factors that are lacking in their game designs and develop strategies to design EG that includes functions of feedback, challenges, goals, and rewards.

For example, EG with immediate feedback and well-planned difficulty levels can provide students with appropriate challenges that enhance their acceptance. These features are vital in creating marketable EG that meets consumer demands and needs. Finally, before purchasing EG, higher-education administrators must also ensure that their academics fully comprehend its functionality.

IV. Limitations of Study

This study focused on the students from Taif University's Computer Faculty as a sample and programming as a subject. However, it is recommended that future research studies should be carried out to strengthen current knowledge on the subject matter. One recommended research direction is a more comprehensive study that involves a larger sample of students and other subjects, or similar research conducted in other universities. This would help in the discovery of similarities and differences among them, which may help to provide new suggestions and recommendations about the use of EG in higher education.

CONCLUSION

Educational games, like other functional types of digital games, contribute to teaching and learning by making education more enjoyable, desirable, and entertaining. Thus, EG educates, creates, and evolves to meet the needs of the modern population. This paper proposes that universities should adopt an open concept to foster individual learning needs through the acceptance of EG. Understanding how a pedagogical approach can be combined with EG incorporating advanced digital-game features is imperative to improving universities' organisational performance. Addressing the acceptance issues of EG based on students' behavioural intention to use, this designed framework aims to provide a better physical environment that will lead to a more sustainable educational setting.

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