# UNIVERSITY OF SOUTHAMPTON

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**A conceptual Framework for Gamified E-Learning Systems Acceptance by students in Saudi Arabian Universities**


By

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Thesis for the degree of Doctor of Philosophy

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## Abstract


Faculty of Physical Sciences and Engineering

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A conceptual Framework for Gamified E-Learning Systems Acceptance by students in Saudi Arabian Universities


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Abdullah Ibrahim A Alzahrani



Universities face many challenges in trying to provide quality and equitable learning to the ever-increasing student numbers efficiently. Most of the challenges relate to limited financing, infrastructure and space, human resources and instruction materials. This calls for increasing resourcing of universities. Unfortunately, most of the literature indicates significant cuts in public funding to universities albeit their enrolment is rising. This necessitates among others rethinking the delivery of higher education. Increasingly, the use of the traditional classroom as the sole means to deliver higher education is proving ineffective and inefficient.

The advancements in information and communication technology (ICT) have created more opportunities for universities to complement the traditional classroom to deliver their curricula. In Saudi Arabia, many universities continue to adopt e-learning systems to deliver their curricula. Nonetheless, reports highlight unwillingness to adopt e-learning systems by students and sometimes staff as a critical challenge. Using a mixed methods approach, this study draws on primary data from Saudi University Students and Lecturers, and empirical literature to propose a Gamified E-learning Systems Acceptance Framework (GELSAF) through a critical analysis of the most potent factors that affect students' intention to accept e-learning systems in Saudi Arabian universities.

Through expert interviews, students' questionnaire and Structural Equation Modelling (SEM), a Gamified E-learning Systems Acceptance Framework (GELSAF3) was generated. Within the GELSAF3 it was found that Game Elements (GE), Perceived Usefulness (PU), Computer Self-Efficacy (CSE), Subject

Norm (SN), and Pleasure (PLS) significantly influence the students' Intention to Use (ITU) gamified e-learning systems in a positive way. On the other hand, whereas Image (IMG) is positively associated with ITU, it does not significantly influence ITU. Based on the magnitudes of the standardized Beta Coefficients and Critical Ratios, the findings indicate that CSE, PLS, and PU were the most influential factors on ITU. Unexpectedly, the measurement model for Facilitating Conditions (FC) did not converge during its estimation due to having fewer measurement items and hence this factor was excluded from further analysis.

The findings of this research were found to be of significant consequence to particularly Saudi Universities which have tried to adopt e-learning systems with limited success. Also, the research provides sound evidence to various stakeholders of higher education that could change the landscape for e-learning systems in Saudi Universities positively. In terms of policy, the study encourages stakeholders to among others have policy frameworks that enable: assessment of their students' needs with regards to e-learning and to identify the key features necessary in such an e-learning system; blending of learning with educational games and play activities; investments in enabling their students to become fully skilled with computers and IT so as to have a positive self-perception of computer skills mastery; taking care of the popular norms of the students' community and also anticipate the dynamics within such norms to inform decisions for adopting gamified e-learning systems.

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Academic Thesis: Declaration of Authorship

I, Abdullah I A Alzahrani declare that this thesis and the work presented in it are my own and has been generated by me as the result of my own original research.

**A Framework for Gamified E-Learning Systems Acceptance in Saudi Arabian Universities**

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;
2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
3. Where I have consulted the published work of others, this is always clearly attributed;
4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
5. I have acknowledged all main sources of help;
6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
7. Parts of this work have been published as:

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Signed: .......................................................................................................................................

Date: .......................................................................................................................................

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# Abbreviations

| | |
|---|---|
| CALC | Computer Assisted Learning Centre |
| CMS | Course Management System |
| EFA: | Exploratory Factor Analysis |
| E-Learning | Electronic Learning |
| GELSAF | Gamified E-Learning Systems Acceptance Framework |
| GELSAM | Gamified E-Learning Systems Acceptance Model |
| HCP1 | first Home Computing Policy |
| ICT | Information and Communication Technology |
| iEN | National Education Portal |
| IS | Information System |
| KSA | Kingdom of Saudi Arabia |
| LMS | Learning Management Systems |
| NCEL | National Centre for E-learning and Distance Learning |
| OU | Open University |
| PLATO | Programmed Logic for Automatic Teaching Operations |
| SEM | Structural Equation Modelling |
| TAM | Technology Acceptance Model |
| TPB | Theory of Planned Behaviour |
| TRA | Theory of Reasoned Action |
| US DoD | United States Department of Defense |
| UTAUT | Unified Theory of Acceptance and Use of Technology |
| VLE | Virtual Learning Environment |
| WebCT | Web Course Tools |
| PU | Perceived Usefulness |
| CSE | Computer self-Efficacy |
| FC | Facilitating Conditions |
| ITExp | Information Technology Experience |

| | |
|---|---|
| ATB | Attitude Towards Behaviour |
| SN | Subjective Norm |
| IMG | Image |
| PEoU | Perceived Ease of Use |
| PEnj | Perceived Enjoyment |
| GE | Game Elements |
| UIL | User Interface Language |
| PLS | Pleasure |
| ITU | Intention to Use |
| GoF | Goodness of Fit |
| CV | Convergent Validity |
| CR | Composite Reliability |

# Chapter 1: Introduction

E-learning systems continue to receive attention in universities worldwide (Selim, 2007). Reports show that learning institutions are increasingly incorporating e-learning into their curricula (Rhema and Miliszewska, 2010). This move is among others aimed at complementing the traditional teaching approach, giving learners a better learning experience, and boosting performance (Kattoua *et al.*, 2016). This implies that e-learning is increasingly becoming an important element in teaching and learning, particularly at universities. Several arguments arise to explain the proliferation of e-learning systems within education systems. Morawczynski and Ngwenyama (2007) argue that the use of ICT can act as a catalyst for improving access to quality education. This is on the backdrop that e-learning breaks the geographical constraints to accessing quality education. On the other hand, e-learning ameliorates the constraints associated with the traditional face-to-face classroom including space and student to staff ratio. According to Singh *et al.* (2005), e-learning is an imperative for universities given its power to promote internationalization of higher education through collaborations and sharing of research and course materials.

From the above, the case for integrating e-learning into the teaching and learning particularly at universities cannot be overemphasized. Unfortunately, some countries and/or institutions are still lagging behind in terms of adopting e-learning. Many such countries are developing countries that tend to face various challenges. For instance, Bhuasiri *et al.* (2012) and Sheerah and Goodwyn (2016) indicate that limited competences of teachers, students and education managers tend to limit acceptance of e-learning in universities.

In as much as the use of e-learning in Saudi Arabian universities is increasing, it is largely in its infancy and at an early adoption stage, with some universities' use of ICT being limited to PowerPoint presentations and using emails to send attachments and assignments to students. Yet, the fact that the country's higher education is undergoing significant expansion due to higher demand for higher education necessitates massive adoption and integration of e-learning systems into the universities curricula. To illustrate, Alamri (2011) notes that the number of students in higher education or tertiary education has increased dramatically over the years in Saudi Arabia. As such, e-learning systems are required to reach a broader range of students. For instance, universities such as Shaqra with a population of approximately 38,500 students and 9 scattered campuses would significantly benefit from adoption of e-learning systems.

In addition, the demand for e-learning derives from the fact that many students in Saudi Arabia still have no access to higher education and require more flexible ways of learning for various reasons (see Albalawi, 2007; Alghamdi, 2016). Some need to study as well as maintain employment or even seek employment while studying. On the other hand, many students wish to study part-time and from home. All these circumstances necessitate a drift from traditional teaching methodologies to more innovative student-centred self-directed learning by learners. This is in alignment with one of the Saudi Arabian national education objectives of “developing such teaching methods, which focus on the Learner not the Teacher, and concentrate on inculcating skills, personality development, improving confidence, and promoting spirit of creativeness” (MOE, 2017a).

Further, there is a noticeable decline in the quality indicators of higher education in Saudi Arabia which could be ameliorated by adopting e-learning systems (Alshayea, 2012). There are reports of overcrowding in universities due to increasing number of learners finishing high school and entering universities (Aljabre, 2012).

Despite the slow progress in adopting e-learning systems in Saudi universities, there are signals of readiness to fast track the adoption of e-learning in the country’s universities to harness the opportunities it carries. For instance, The Online Islamic University was launched in 2010 and The Saudi Electronic University in 2011. Similarly, major universities such as King Saud University, King Abdul Aziz University and King Fahd University of Petroleum and Minerals, have established e-learning and blended learning to improve the quality of learning (Alebaikan, 2010). Equally, latest statistics from the Ministry of Education (MOE, 2017b) released in 2015-2016, show each university has a deanship of information technology and distance learning. This signals the government has a strategic interest in e-learning and considers it to be an important subject matter (Al-Shehri, 2010).

It is critical to acknowledge the existing barriers in Saudi Arabia to the proliferation of the e-learning systems in the universities. Poor infrastructure in many universities and colleges (Krieger, 2007), limited skills possessed by students and the faculty on using e-learning systems effectively (Alkhalaf *et al.*, 2010). In addition, the unwillingness of students, parents and the faculty to fully adopt e-learning systems in universities due to the long-time disapproval of such learning by key stakeholders in the country including employers (Alkhalaf *et al.*, 2010). If not addressed these barriers may threaten the achievement of quality education for all that the Saudi Arabian government has promised in its vision 2030.

Out of the above highlighted barriers to adoption of e-learning systems, some reports indicate that students' unwillingness and/or resistance to adopt the system is the most influential factor that needs to be addressed with urgency (Al-Harbi, 2011a). A similar view is held by Panda and Mishra (2007) who posit that user acceptance is the antecedent to the successful implementation of an e-learning strategy. In as much as the aforementioned authors suggest learner acceptance is a critical barrier to adoption of e-learning systems in Saudi Arabia, there is slight evidence to support their observations.

This study therefore undertakes to contribute to this growing area of research by investigating the factors that affect students' acceptance of gamified e-learning systems in Saudi Arabian universities. The research is based on the conjecture that intention to use gamified e-learning systems in universities is attributable to various students' perceptions that shape their attitudes towards the use of gamified learning systems. Therefore, if the significant factors that make students unwilling to adopt e-learning systems are addressed, it is to be expected that there will be a higher likelihood for universities to adopt e-learning systems.

## 1.1 Definitions:

**Technology adoption**:

A term that refers to a process where a user becomes aware of a technology and at the end, the user will embrace that technology and make a full use of it. Usually, when a user adopts a technology then they will be keen to ensure the existence of that technology when there is need for it (Renaud and Biljon, 2008). The terms adopt, adoption and/or adopting have been used as mentioned in the sources that have been relied upon in this research while preserving the meaning indicated by them.

**Technology acceptance**:

Refers to the attitude of a user towards a technology which is affected by different factors (Renaud and Biljon, 2008). In this research, technology acceptance is the process where students show a positive attitude towards gamified e-learning systems, behavioural intention to use them and make a full actual use of them.

## 1.2 Statement of the problem

Universities face many challenges in trying to provide quality and equitable learning to the ever-increasing student numbers efficiently. Most of the challenges relate to limited financing, infrastructure and space, human resources and instruction materials. This calls for increasing resourcing of universities. Unfortunately, most of the literature indicates significant cuts in public funding to universities albeit with their enrolment rising. This necessitates among other things rethinking the delivery of higher education. Increasingly, the use of the traditional classroom as the sole means to deliver higher education is proving ineffective and inefficient.

The advancements in information and communication technology (ICT) have created more opportunities for universities to complement the traditional classroom to deliver their curricular. In Saudi Arabia, many universities continue to adopt e-learning systems to deliver their curricula. Equally, to demonstrate its commitment towards e-learning, the government of Saudi Arabia established The Online Islamic University launched in 2010 and The Saudi Electronic University in 2011.

Nonetheless, despite increasing demand for higher education that cannot be satisfied by the traditional classroom instruction, the slow pace with which universities are adopting e-learning is noticeable. Some reports highlight high anxiety amongst Saudi students towards adopting e-learning systems as a critical challenge for the proliferation of e-learning in Saudi Arabian Universities. There is however, limited evidence generated to support the above assertion. To this end, this research undertakes to investigate the factors that affect students' acceptance of gamified e-learning systems in Saudi Arabian universities. This has been done through among others reviewing several technology acceptance models including the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), the Technology Acceptance Model (TAM) (Davis *et al.*, 1989), the Theory of Planned Behaviour (TPB) (Ajzen, 1991), and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh *et al.*, 2003), which have been extensively used to investigate changes in behaviour and factors that influence technology acceptance.

## 1.3 Research Motivation

The outcome of this research is a suggested Gamified E-learning Systems Acceptance Framework (GELSAF3) that would be of critical importance to among others the universities, university students, and government policy makers.

The research will provide universities with sound evidence on the strategic interventions required while planning for the adoption of gamified e-learning systems. Such factors would reduce the chances of failure and slow pace of adoption of new technologies that are rampant in the higher education institutions in Saudi Arabia. This evidence is critical at a time when there is a surge in the demand for higher education in Saudi Arabia and increase in the demand for other modes of study that depend on technology. Similarly, this research is critical to be undertaken at the moment when there is pressure against universities to blend traditional classroom practices with non-classroom teaching and learning practices in order to guarantee more access to higher education.

This research was undertaken to understand students' behaviours, norms and perceptions that sometimes limit success of adopting e-learning systems. This would act as the basis for students to participate actively and positively to influence the processes leading to adoption of new e-learning systems. In other words, this research acted as a catalyst to encourage universities to listen to students and give them more space to inform all the processes leading to the adoption of new e-learning systems. This is more likely to guarantee survival of the system after adoption and hence save loss of money arising out of botched programmes.

Further, this research renews focus on integration of ICT into the teaching and learning processes which is in alignment with the country's National Vision 2030 that promises quality and equitable education to all Saudi citizens. Such a promise has a lot of ramifications on enrolment and learning outcomes that are ameliorated using technologies. It is anticipated that government shall use the evidence carried by this research to further develop policies that could promote and fast track the adoption of e-learning technologies within universities in the country.

It is imperative to note that this research could be among the few to examine the issue of using game elements to increase the likelihood for adoption of gamified e-learning systems. This is of critical importance given the general low quality of instruction at higher institutions leading to loss of interest in learning by students at institutions of higher learning. Particularly, this study is expected to generate sound evidence on the critical game elements that have higher impacts on the teaching and learning processes. This would inform decisions of universities during the period of procuring e-learning systems.

## 1.4 Research Questions

This research seeks to address the main following question: What is an appropriate framework with which to determine the acceptance of gamified e-learning systems by students in universities in Saudi Arabia? Two sub-research questions were derived from the main research questions as follows:

Q1: According to literature, what are the factors that constitute the GELSAF?

Q2**:** What are the factors that influence students' acceptance of gamified e-learning systems?

Based on the critical literature review, a framework has been developed and validated by conducting a sequential exploratory study using a methodological triangulation technique.

## 1.5 Research Objectives

Based on the research questions, this research aims to contribute to this growing area of research by investigating the factors that affect students' acceptance of gamified e-learning systems in Saudi Arabian universities. This aim can be achieved by fulfilling the following objectives:

To Review the literature pertaining to models of technology acceptance, and develop and validate a conceptual model for GELSAF of e-learning systems.

To establish the factors influencing students' acceptance of e-learning systems for integration into the GELSAF model.

## 1.6 Thesis Structure

Overall, this study is divided into nine chapters. The first chapter is the introduction and it provides the background that the reader needs to understand the subject of the report and it also includes the research objectives and questions that are later answered.

Chapter two is concerned with the literature review on the key thematic areas of the study including e-learning and e-learning systems, gamified e-learning systems and their elements and benefits.

Chapter three deals with the factors affecting acceptance of e-learning systems. The chapter introspects the various models for technology acceptance and models of e-learning uptake in institutions of higher learning and it ends by identifying research gaps that need filling.

Chapter four handles the research framework and it is in this chapter that the initial attempt is made to propose a gamified e-learning systems acceptance framework (GELSAF1) with individual factors, systems factors, and social factors.

Chapter five is the methodology chapter where the procedure for conducting the research is discussed from the research methods employed by the study, data collection, analysis and tools for data collection to model validation.

In chapter six, the findings and discussions around the initially suggested framework is done with the intent to modify the initially suggested GELSAF1.

Chapter seven is dedicated to quantitative data analysis and presentation of the quantitative results arising out of factor analysis and structural equation modelling.

The findings of the study are discussed in chapter 8 and conclusions are drawn in chapter 9. It is in chapter 9 that reflections on the possible areas for future work are given.

# Chapter 2: Literature Review

This chapter presents a literature review focused on e-learning, e-learning systems and gamification.

## 2.1 E-Learning

The idea of e-learning arose from the need for non-traditional learning that could be accessed using the Internet (Chang, 2015). People can learn and practice on their own or be taught by others. Either way, they gain insights into concepts that were initially unfamiliar to them. E-learning is a subject that has been studied by many researchers in order to provide a better understanding of its essence. Understanding what e-learning is helps to construct better ideas about related and relevant topics such as e-learning systems. E-learning is performed and then uses interactive learning as a recommended method for staff training in industry and academia. Interactive learning is focused on the integrated e-learning and face-to-face learning to ensure that the process of learning can stimulate learners' interests, report their progress and have tutors to provide their feedback and guide learners to meet the expected targets (Chang, 2016). Various thoughts and different definitions of learning have already been provided by several researchers some of which are described in the subsequent sections.

### 2.1.1 Definition of E-Learning

The history of e-learning lies within the evolution of technology over the last decade (Schlosser and Simonson, 2009). From an academic perspective, e-learning can be defined as a process of learning involving use of electronic technologies to access curriculum outside of traditional classrooms (Chang, 2015). It describes anything delivered through electronic technologies for learning purposes. With the emergence of new technological devices, e-learning can be undertaken on desktop or laptop computers, smartphones, and tablets (Clark and Mayer, 2016) and other forms of technology such as audio and video discs, satellite broadcasting of lectures, and interactive televisions (Klašnja-Milićević *et al.*, 2016). E-learning assists with delivering learning materials to students and avoiding the overcrowding of educational institutions. It also helps to overcome the problem of staff shortages (Asiri *et al.*, 2012).

Judging by the few definitions that exist, e-learning can be understood as a way through which information or material used for learning purposes can be delivered to students using technologies, and especially those which are currently popular such as personal computers (PCs), laptops, tablets, and smartphones.

The evolution of e-learning started with the expansion of network communication in the 1960s (Harasim, 2006). E-mail and computer conferencing were among the technologies used to serve e-learning (Harasim, 2006).

A great example of e-learning is the Open University (OU), which was established in 1969 in the United Kingdom, and which has a clear aim – to be accessible to people, and open for ideas (OU, 2017). In May 1968, Walter Perry was appointed Vice-Chancellor of the OU. He believed that the traditional standard of teaching was deplorable. He was among those who believed that the new media devices would enhance the traditional standard of teaching (OU, 2017). The OU started teaching in January 1971 and was one of the great contributors to e-learning. Indeed, it developed services that helped students to become educated. For example, in 1981, the OU in collaboration with Milton Keynes Development Corporation, developed the first interactive videodisc and the Cyclops machine. This was an 'electronic blackboard' that linked students with teachers and provided them with a connection over the telephone and an opportunity to draw on the screens. In 1982, video cassettes were introduced as an alternative course component. With the passage of time, the OU was making increasingly noticeable contributions to the field of e-learning by introducing different services to students of distance learning (OU, 2017).

It is evident that e-learning provides students with some useful features, such as studying at their own pace, anytime, and anywhere. E-learning is only a learning approach if it combines all the learning transactions (tell, show, ask, response, and feedback), otherwise, it should not be considered as e-learning. Indeed, if technologies are only used to deliver learning materials, then e-learning should be considered as e-delivery rather than e-learning in terms of its wider concept.

## 2.2 E-Learning in Saudi Arabia

The use of e-learning systems in Saudi Arabian universities is rising rapidly due to the growth of Information and Communication Technology (ICT) (Al-Shehri, 2010). According to MOE (2017b), in their last statistics released in 2015-2016, Saudi Arabia has 28 government universities, and 30 private universities. Each university has a deanship of information technology and distance learning (Al-Shehri, 2010). This demonstrates that the government of Saudi Arabia has become interested in e-learning and considers it to be an important subject matter (Al-Shehri, 2010). In addition, the numbers of higher education or tertiary education students have been rising dramatically over the years which requires solutions to provide education outside the traditional classrooms (Alamri, 2011).

However, there are still several challenges preventing the complete adoption of e-learning systems. For example, at Shaqra University, which has approximately 38,414 students and 9 scattered campuses, e-learning would be a wonderful way to achieve education objectives. However, at present, Shaqra University has no plan to adopt e-learning using an e-learning system. There are many reasons for this, among which is students' unwillingness to accept e-learning systems. The present research will contribute to the e-learning strategies of Shaqra University and many other universities, which still have no plan to implement e-learning systems. Indeed, the present study will give them an insight into how understanding students' perceptions of gamified e-learning systems can help them create or improve their e-learning plans and strategies.

## 2.3 E-Learning Systems

Learning materials can be delivered through computers, smartphones, and tablets using e-learning systems. E-learning systems are used to deliver learning materials in an organised and efficient way. In this section, definitions of 'a system', 'an e-learning system' are provided. In addition, a history of e-learning systems and different ways of utilization were presented.

### 2.3.1 Definition of a system

Before defining what an e-learning system is, 'a system' will be defined. To serve this purpose, a description of a 'system' has been provided by Gilbert and Gale (2008) in their book "Principles of E-Learning Systems Engineering", where they stated that according to systems theory, a system is a thing that has certain characteristics. These characteristics are as follows: it operates within an environment; has boundaries that distinguish it; takes inputs; gives outputs; is capable of processing; has a control subsystem; has emergent properties; utilises resources and operates through authorisation. Hence, a system is a set of methods and procedures that have been created to solve specific problems or perform certain activities within specific boundaries.

### 2.3.2 Definition of an E-Learning System

An e-learning system is a software application through which education materials are sent (Kats, 2013; Alshaher, 2013; Chang, 2015). On the other hand, Cheng *et al.* (2010) defined an e-learning system as a software system that is built for the purpose of supporting learning and educational environments. Because there are many different e-learning systems provided by many providers, these systems differ in terms of specifications, components, and features. Some may provide only a few features, such as online courses, while some provide multiple features such as online courses, grade tables, students' management etc.

E-learning systems are used to deal with or control different learning activities. For example, an e-learning system provides tools with which to manage online courses, e.g., adding courses and registering students, and monitoring them throughout the duration of the course.

In this research, an e-learning system is a software system that supports the process of e-learning by involving the possibility of sending educational material by the teacher to the students, the possibility of the participation of students by responding to the teacher, also through the possibility of monitoring the activities of students during the educational process. The implementation of game elements (see 2.4.6) also has to be supported by this e-learning system.

### 2.3.3 History of E-Learning Systems

The origins of e-learning systems can be traced back to 1960, when the Programmed Logic for Automatic Teaching Operations (PLATO) system was created (Cheng *et al.*, 2010). The University of Illinois saw the need to deliver coursework through an automated learning system, which Donald Bitzer was instructed to create. The first model of the PLATO consisted of a TV screen on which the coursework could be displayed, and a keyboard dedicated to navigating through the menus. This system continued to evolve over the years, acquiring more functionality (Cheng *et al.*, 2010).

In the late 1960s, the United States Department of Defense (US DoD) promoted the development of the ARPANET, which morphed into what is known today as the Internet. Fast-forward to the 1980s, and the Computer Assisted Learning Centre (CALC) Online Campus was established, allowing teachers to provide learning resources to learners through the Internet (Byrne, 2016).

By 1995, people around the world had access to the Internet provided they had a telephone line, a modem and a computer (Cheng *et al.*, 2010). Learners began to benefit from real-time access to learning materials. Students were able to engage in-group discussions with their teachers, exchange experiences, and make inquiries when necessary. This marked the beginning of e-learning systems as they are known today. Since then, different online educational programs began to emerge. These included WebCT (Course Tools), which provided learning materials through web pages. The developer, Murray Goldberg, saw this as an opportunity to improve learners' satisfaction levels and boost their overall performance (Cheng *et al.*, 2010). Soon after, Blackboard Inc. was created. This platform is currently utilised by thousands of learning institutions in different countries around the world. Other systems such as Moodle, have also been introduced to the market. Students and teachers can now choose from the many e-learning systems available. More e-learning systems, with improved functionalities and efficiency, are expected to be introduced (capterra.com, 2017).

### 2.3.4 Use of E-Learning Systems

E-learning systems make it possible for students to be taught without time or geographical restrictions. Students can obtain all the information or, more specifically, they can obtain the educational materials they need anytime and anywhere (Kats, 2013). In addition, e-learning systems are utilised in various sectors. One example of this is their use in learning institutions to deliver education to students. These e-learning systems allow for interactions among teachers and students, which are a crucial part of the learning process. Students are able to receive what the teacher tells, shows and asks, following which they can submit their responses online while the teachers provide feedback in the same way.

E-learning systems are usually varied in terms of their properties and features. Educational institutions can choose what helps in achieving their education objectives, and what suits their financial budgets.

## 2.4 Gamification

Technologies, or more specifically, personal technical devices, have been used in many different areas; they help people to perform tasks at a faster pace and more effectively, e.g., accessing reading resources, text typing, photo processing, video producing, and many other activities. Education is one area that involves technologies as a valuable supplementary tool to educate students. However, this tool might be boring to some students, and thus researchers have been investigating how to make the use of technological devices such as computers, tablets, and smartphones in education more Interesting. Benefits of the e-learning are evident when the students were motivated and have more desire to learn (Chang, 2015). Therefore, among many different learning approaches, gamified learning has emerged. The idea behind gamified learning is that the game-design context is applied to learning to make it more fun and enjoyable. This is called gamification.

### 2.4.1 Definition of Gamification

The word "game" is the root of gamification (Kapp, 2012). Salen and Zimmerman (2004) defined a game as "*a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome*". In a learning context, the player is a "learner" or a group of learners (Kapp, 2012) or can be called a student or a group of students.

The term gamification was not popular prior to 2010 (Morford *et al.*, 2014). However, it was referred to using different or alternative names such as serious games, persuasive games or reality games. Other terms and concepts that have similarities include game-context, game-inspired design, simulations, and games (Morford *et al.*, 2014).

Gamification is defined as using the elements of games and the techniques of game-design, and applying them to a non-game context (de-Marcos *et al.*, 2014). Gamification is used to engage individuals, motivate them, and help them solve problems; it is also used to change individuals' behaviour (de-Marcos *et al.*, 2014; Hamari and Koivisto, 2013). Alternatively, Yu-kai Chou classed gamification as *"the craft of deriving all the fun and addicting elements found in games and applying them to real-world or productive activities"* (Huang and Soman, 2013).

The concept of gamification helps to address problems in different areas, including health, education, and business (Morford *et al.*, 2014). This is based on taking the concepts used in games and applying them to a non game-context concept (Morford *et al.*, 2014). For example, gamification can be used to enhance students' motivation and engagement. Furthermore, gamification can be used to change individual behaviour towards different activities (Huang and Soman, 2013).

The term gamification seems to be confusing in that there are multiple definitions that refer to similar terms. While gamification is the use of game elements in a context that is not primarily a game-context, game-inspired design, serious games, simulations, and games have different meanings. Game-inspired design is defined as the utilisation of ways of thinking that are used predominately or essentially in games. It does not refer to the use of a game element, but instead pertains to the use of playful design. Serious games are games that are designed for different purposes, such as training and fun (Kiryakova *et al.*, 2014). Simulations or Sims represent *"a broad genre of experiences including computer games for entertainment and immersive learning simulations for formal learning programs"* (Aldrich, 2009). Games include all of the aforementioned terms, which in the end are designed for the purpose of entertainment (Kiryakova *et al.*, 2014).

Gamification can make a non-game context more enjoyable and attractive. Using gamification can help learners (students) to become more motivated. The use of gamification could potentially raise the acceptance level of e-learning systems among students in Saudi Arabian universities.

### 2.4.2 Motivation principle in Gamification

**Self Determination Theory (SDT)** by (Ryan and Deci, 2000; Ryan *et al.*, 2006) is a motivation theory that has been highly discussed and was adopted in gamification. The focus of the discussion that was targeted when talking about this theory is the focus on the influence of game elements on the extrinsic motivation of the player's motivation and engagement through which the intrinsic motivation is undermined (Cheong *et al.*, 2013; DomíNguez *et al.*, 2013; Montola *et al.*, 2009; Thom *et al.*, 2012). This theory consists of three basic psychological needs which are competence, relatedness, autonomy (Ryan and Deci, 2000):

1- The need for **competence**: the desire of having control over the environment and outcomes. It is the desire to know how things will progress and what the outcomes are of our actions.
2- The need for **relatedness** deals with the desire to interact, be connected, and take care of others. People seek belongingness by involving others in their daily actions and activities.
3- The need for **autonomy** concerns the motive and reasons behind our actions and ability to perform in harmony with our integrated self. Being autonomous does not mean that you have to be independent; however, it does mean that you need to be having control over your actions.

**ARCS model of motivation design** which was introduced by Keller (1987), is another motivation theory that is applicable to gamification (Hung *et al.*, 2011; Kim and Lee, 2015). This model consists of four steps; Attention, Relevance, Confidence, and Satisfaction (ARCS) that help promoting and sustaining motivation in the learning process (Keller, 1987), and they are described as follows:

**Attention**

- This can be achieved in two ways:
    - Perceptual arousal – gaining interest using surprise or uncertainly.
    - Inquiry arousal – use of challenging assignments or problem-solving techniques.

**Relevance**

- This can be gained by starting relevance in order to increase motivation. This can be done by using real and tangible language, and understandable examples.

**Confidence**

- Let learners know how likely they are to succeed. The more learners understand that it is impossible to achieve the goals, the less motivated they will be.

- Explain to students how likely they are to succeed by clarifying the required effort requirements and evaluation criteria.

- Allow for meaningful success.

- Allow students to grow in the learning process through simple steps.

- Provide students with feedback and support internal attributions for success.

- Allow students to feel that they have control over their learning and tasks. It is important for them to link the achievement they reach with the effort they are making.

**Satisfaction**

- Students should feel that they receive some reward and appreciation either because they have achieved an achievement, praise from their teacher, or just for entertainment.
- Creating opportunities for students to take advantage of the skills they have acquired previously, which makes them feel that the skills they have acquired are useful.
- Provide students with feedback and reinforcement. When students appreciate a result, it increases motivation. Satisfaction is based on motivation, which can be intrinsic or extrinsic.

The ARCS model was developed to get to understand factors that influence learning motivation of learners. In addition, to provide more attractive learning environment as well as enhancing learners' motivation. In the field of gamification, the ARCS is applicable when the learning process contains educational games application, and this called game-based learning (Hung *et al.*, 2011; Kim and Lee, 2015).

From the above, STD and ARCS are useful to be applied in gamification. SDT can be implemented in gamification but with its comprehension of concept and empirical evidence. On the other hand, ARCS model is commonly used in the learning environment.

### 2.4.3 The effectiveness of gamification in increasing motivation

Ejsing-Duun and Karoff (2014) in their study, "*Gamification of a Higher Education Course: What's the fun in That?*" explored how game elements – when introduced into a university course – change students' behaviour and interactions. The course that was presented to students was a 24 hours course divided into six sessions. The course involved real problem solving and was mainly designed by the teachers. The design of the course was meant to assess the effect on perception of students of the course. The course assessment awarded point to assess students. The reason behind using awarding point was to introduce the dynamics of play and competition. To keep track of students' progress, Youtopia (a content management system) was used. This content management system provided teachers with some game elements such as points and badges as awarded. In their study, gamification was divided into two different aspects; gamification as playability and gamification as playing and learning. The analysis of the data gathered through the course sessions and from interviews with the students who participated in this research shows that game elements affect motivation either positively or negatively as well as influencing learner's interactions with each other.

Their study helped to gain an understanding of the importance of gamification in terms of raising learners' interaction with each other and increasing their motivation through the use of the elements of the game. However, their study involved a few game elements such as points, badges, avatars, and leader boards, which allowed the researcher to take advantage of this shortage of game elements used in their study and apply a comparable study but using many different elements of the game.

O'Donovan *et al.* (2013), in their article *A Case Study in the Gamification of a University-level Games Development Course,* investigated how gamification could raise engagement as well as encouraging targeted behaviour towards users. Their goal was to improve the attendance at lectures, content understanding, problem solving and general engagement, by applying gamification to education context. The gamification was applied through an existing computer science course. The gamification was applied with focus on 2D games design. The environment used is Vula (an online management tool) combined with in-class activities. The study involved comparison of benefits and costs by analysing the course grades, lecture attendance, lecturer evaluations and a student questionnaire. The costs were taken to be the monetary and time investment required to build and maintain the system. The findings conclude that the approach used in this study was effective in a university setting. For instance, the gamification techniques used in the design helped improving students' participation and engagement. In addition, there was a significant improvement of students in course marks which was statistically measured using Likert scale (5 points scale). The leader board was found to be highly motivating, steam points[1] and ranks came in second place, and the end prize and badges were found to be least motivating.

Finally, the gamification techniques used in their study had a statistically significant impact on students' attendance. Nonetheless, the authors acknowledge that the results of this study are sensitive to small changes in implementation and therefore recommend the need for more monetary and time investment to succeed.

### 2.4.4 Playfulness/discovery learning in higher education

According to Kangas (2010), playfulness as applied in education is an approach to teaching and learning processes that entails the use of playful and physical activities that take place in a playful learning environment. Generally, playfulness is a common approach to teaching and learning in early-years education since children learn better through using their senses including seeing, touching among others. It is however emerging that higher education institutions are adopting playfulness as an approach to learning and teaching. DuBravac (2012) illustrates that institutions of higher learning are adopting the use of playfulness to increase learner engagement, motivation and enjoyment of the learning and teaching processes. Nørgård *et al.* (2017), indicate that there is growing disengagement and loss of motivation amongst students in institutions of higher learning due to poor pedagogy, stressful learning environments and disconnection between higher education curricular and reality among others. To this end, gameful approaches and gamification techniques are increasingly being adopted to counter the challenges aforementioned. Nonetheless, Boyle *et al.* (2016); Deci *et al.* (2001), warn that the benefits of playfulness to learning and teaching tend to be short term in nature and that the approach focuses mainly on extrinsic motivation through manipulation of the external environment which may actually diminish intrinsic motivation in the long run. To this end, caution needs to be taken particularly in the design of play activities to ensure that they impact both intrinsic and extrinsic motivation of learners and engagement for long-term benefits to be realised.

### 2.4.5 Benefits of Gamified E-Learning Systems

Using gamification in education motivates learners and increases their interactions with educational materials. The learning objectives can be achieved through implementing gamification in e-learning

[1] "Steam points" are used by players to buy new games or to get games add-ons from store.steampowered.com

systems, which makes the e-learning more fun and enjoyable (Albilali and J. Qureshi, 2016). Moreover, gamification helps to improve students' interactions with educational materials while simultaneously motivating them to level up in their courses and develop new skills (Huang and Soman, 2013; Amory *et al.*, 1999). There is also some agreement that gamification encourages students to register for new courses and achieve high grades in those courses (Huang and Soman, 2013). In addition, gamification raises students' engagement and motivation (Kiryakova *et al.*, 2014). According to ESA (2016), 63% of American households have at least one resident who plays video games regularly. The report stated that the average age of players is 35 years old. Michael D. Gallagher, president and CEO of the Entertainment Software Association, stated that video games will be the future of education (ESA, 2016). Amory *et al.* (1999) agreed with this, stating that play is a widely acceptable mode of learning.  All these benefits conclude that gamification is a powerful approach that can be used to make education more interactive, engaging and motivational.

### 2.4.6 Use of Game Elements to Gamify E-Learning Systems

As mentioned in Section 2.4.1, gamification is the use of game elements in environments that are not primarily dedicated to games. For example, game elements can be used to gamify application software, such as e-learning systems (Deterding *et al.*, 2011). The term "serious game" is used to refer to a complete game with a serious intention and which is designed accordingly; however, only certain elements are used to gamify application software (Muntean, 2011). Simply put, gamified application software uses some game-design elements that are used in games (Deterding *et al.*, 2011).

Game elements have been described differently by researchers; some researchers have described game elements based on their types, while some others have identified them based on their functionality (Amory *et al.*, 1999). The following are game elements used in different gamified application software, which are used to serve different purposes, such as education, health, and organisational training purposes (Hamari *et al.*, 2014; Pedreira *et al.*, 2015).

**Avatar**: A picture that represents the profile of the player.

**Badges**: Provided as an icon and given to a player as a reward when the player achieves a goal.

**Challenges/tasks**: Challenges and tasks that the user performs to attain defined objectives.

**Feedback**: Immediate comment given when the player has completed a specific task.

**Leader boards**: A list of players, which usually displays players' names and their points in ascending order (highest to lowest).

**Levels**: Stages, with a player having to complete each level in order to go to the next level.

**Points scoring**: Points scoring is presented as numbers given when a user completes a given task.

**Progression**: A progress bar that shows the progression of the player.

**Ranking**: This shows the position of players using different criteria such as points and levels.

**Rewards**: Incentives given to players to achieve their goals.

**Roles**: The ways that players take part in the game.

**Users**: All participants (students in our case).

### 2.4.7 Demands of game elements

To indicate demand on game elements, a range of game elements (represented on Figure 2-1) were represented to students in the second data collection process which was done by sending a questionnaire to 444 students in different universities in Saudi Arabia. This was done in order to obtain their opinions about what game elements should be added to an e-learning system so a user can feel the e-learning system is gamified. The question asked was *"What game elements you think should be added when gamifying an e-learning system?"* The next chart represents the frequency of the results.

From the plot below, four game elements, rewards, challenges and tasks, points, levels have ratios of greater than 50%, which indicates that these game elements are more desired than the other game elements listed, therefore they are recommended to be considered primary game elements that should be added to any gamified e-learning systems. The other game elements were also amongst those which should not be neglected as most of them have ratios of higher than 30% which indicates that they are still in demand.

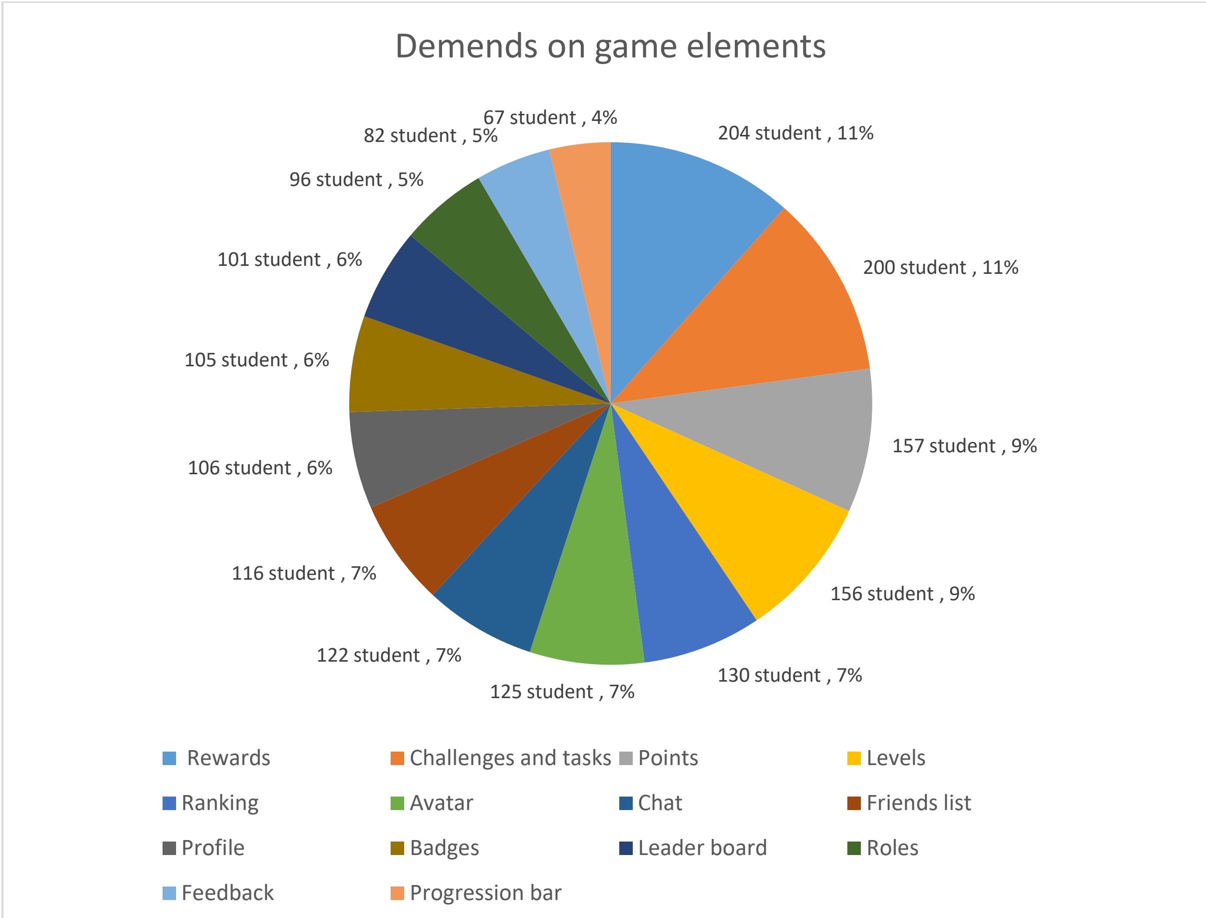


*Figure 2-1 Demands of game elements*

On the other hand, Huang and Soman (2013) found specific types of game elements should be applied including points, leader boards, levels, badges, virtual goods, interactive cooperation, storyline, time restrictions, and aesthetics to trigger better reactions from students.

According to new era (2016), the five key elements that should be considered to improve education through devices in United Kingdom are progress, rewards, collaboration, independence, ranking.

Previous findings in addition to the articles of the other authors show that the perceptions of the students about game elements may vary from place to place and this emphasizes the importance of continuing studies according to time and place.

### 2.4.8 Limitation on Gamification Support in E-Learning Systems in Saudi Arabia

Universities in Saudi Arabia use special systems for e-learning. These systems are built either through in-house development or through collaboration with other e-learning systems providers.

**JUSUR**: JUSUR is an LMS rather than just an e-learning system. It was built by the National Centre for E-learning and Distance Learning (NCEL). JUSUR has approximately 17 tools in addition to serving as an e-learning system which are: controls for courseware, course description tools, announcements, a management system for learning content, glossary, forum, general discussion board, file sharing system, assignments, quizzes and assessment, virtual classroom, lecturer information, user management, survey manager, questions bank, grading book, and tracking for participation (Asiri *et al.*, 2012). JUSUR is among those LMSs which are not gamified[2].

**Blackboard Learn**: Blackboard Learn is widely used and has been fully supported by Blackboard Inc. since 1997. This product offers several useful solutions for education. The system is used by certain Saudi Universities such as King Abdulaziz University, Saudi Electronic University, Qassim University, and King Saud University. As is the case with JUSUR, Blackboard is not a gamified e-learning system[3].

**Moodle**: Moodle is an open source system built by the Moodle project, and which is controlled by Moodle Pty Ltd, based in Perth, Australia. However, this system is not widely used in Saudi Arabia. Moodle has some gamified plugins; however, these are limited, and include the Level Up tool which provides students with badges and a level progress bar[4].

**iEN**: The National Education Portal (iEN) is a product which was created by the Saudi Arabian Ministry of Education. This product provides teachers and learners with several services such as e-books, interactive enrichments, individualised learning, play and learn, reading stories, and watch and learn. Gamification in this product is limited; it provides some games for elementary and middle-school students[5].

**acaDOX**: This product, as described on acadox.com, provides several features such as course management system, instructor tools, e-portfolio, virtual classrooms, community social hub, support for smartphones, and intelligent reporting. However, this product does not support gamification.

This above discussion was written after reviewing the websites of e-learning systems mentioned above.

[2] https://jusur.elc.edu.sa
[3] https://blackboard.soton.ac.uk
[4] https://moodle.net
[5] https://ien.edu.sa

As such, and as shown above, many universities in Saudi Arabia that use e-learning systems appear not to be paying attention to the importance of gamification as a feature or service through which students can be motivated, engaged, and accept e-learning systems[6].

However, in 2019, the ministry of education in Saudi Arabia started to pay attention to the importance of gamification in education. The ministry of education in Saudi Arabia has adopted Classera[7] which is a gamified e-learning system that includes several essential game elements such as rewards, points, badges, and progress bar. This platform allows students to learn at their own pace and do their assignment online. This platform allows students to have a gameful experience such as the one they experience when they play games. They can afford points, level up in their class, get rewarded and achieve some badges.

## 2.5 Factors Affecting the Acceptance of E-Learning Systems

The adoption of e-learning systems has drawn serious attention from many universities. Indeed, students have different opinions on e-learning systems. Moreover, several factors have been deemed to have an effect on students' behavioural intention to accept e-learning systems. This section focuses on reviewing several models and theories, which contribute to the acceptance of e-learning systems and which, in return, can be used to investigate the acceptance of gamified e-learning systems. Based on these models, several factors which affect the intention to accept gamified e-learning systems will be identified. Additionally, studies conducted at different universities will be reviewed to understand students' perceptions of, and attitudes towards e-learning systems. Based on these studies and reviews, a research gap will be identified which requires further investigation.

### 2.5.1 Models and Theories of IT Acceptance

There are numerous models and theories which seek to explain people's varying reactions to new technologies. With regard to the purpose behind these models and theories, examining them thoroughly will help to understand why there may be different reactions among students at the universities of Saudi Arabia when a gamified e-learning system is implemented. Descriptions of the relevant models and theories are provided in the subsequent sections.

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[6] https://www.acadox.com
[7] https://fg.moe.gov.sa

#### 2.5.1.1 Theory of Reasoned Action (TRA)

The Theory of Reasoned Action, formulated by Fishbein and Ajzen (1975), is a fundamental theory of human behaviour that is inspired by social psychology. This theory has been used by Davis *et al.* (1989) to study behaviour towards technology and the results match those of other studies which have analysed behaviour in other contexts (Venkatesh *et al.*, 2003). This theory has two core constructs, namely, attitudes towards behaviour and subjective norm. The attitudes towards behaviour factor is defined as a person's feelings about performing a behaviour, which are likely to be either positive or negative (Fishbein and Ajzen, 1975). The term subjective norm is defined as the perception of a person considering the thoughts of the people most important to him or her when deciding whether or not to perform the behaviour (Fishbein and Ajzen, 1975).

#### 2.5.1.2 Technology Acceptance Model (TAM)

TAM has been applied in various research studies and is widely used to predict information technology acceptance. TAM was constructed to serve the IS context (Venkatesh *et al.*, 2003; Gefen and Straub, 1997). Eke (2011) indicated that TAM was the first model to discuss psychological factors affecting adoption of computers. This model has been developed by Davis *et al.* (1989), with improved versions including TAM2 (Venkatesh and Davis, 2000) and TAM3 (Venkatesh and Bala, 2008).

TAM explains the behavioural intention for technology acceptance and IT usage. In TAM, usage behaviour, which is different from the definition of usage behaviour in the TPB, is constructed as a direct function of behavioural intention. Behavioural intention includes two constructors, namely perceived usefulness and attitude, which is determined by perceived usefulness and perceived ease of use. TAM is considered as a special case of TRA with two determinants for attitude without considering subjective norm and the influence of social control factors on behaviour (Chang *et al.*, 2018).

The original TAM started with two core constructs or predictors, namely, perceived usefulness and perceived ease of use. TAM2 includes subjective norm, image, job relevance, output quality, result demonstrability, experience and voluntariness as other predictors. TAM3 noticeably includes more predictors or determinants such as computer self-efficiency, external control perceptions, computer anxiety, computer playfulness, objective usability, and perceived enjoyment. Many studies have agreed that TAM is able to predict individual intention to accept technology completely or partly (e.g. Hu *et al.*, 1999; Mathieson, 1991). However, Legris *et al.* (2003) stated that TAM and TAM2 are not as useful as when they are integrated into a wider model, such as the theory of planned behaviour (TPB), task-technology fit or any other model that includes human and social change process variables. The Technology Acceptance Model has been used to explain the use of several information systems and technologies, such as the use of emails, the World Wide Web, broadband and online shopping, among others. TAM was designed to explain computer usage behaviour and predict individual adoption, as well as the use of information systems or information technologies (Praveena and Thomas, 2013).

#### 2.5.1.3 Theory of Planned Behaviour (TPB)

TPB has extended the TRA by adding one construct, namely perceived behaviour control. Ajzen (1991) alluded to several studies which used the TPB to investigate individuals' behaviour and attitudes towards different types of technologies (Mathieson, 1991; Hadadgar *et al.*, 2016). TPB has three core constructs, namely, perceived usefulness, perceived ease of use, which are adopted from the TRA, and perceived behaviour control. These constructs have been used together to describe users' perceptions of behavioural intention to use e-learning systems (Hadadgar *et al.*, 2016).

#### 2.5.1.4 The Unified Theory of Acceptance and Use of Technology (UTAUT)

UTAUT has been employed in various research as a framework to measure technology use and adoption. The UTAUT is based on four constructs, namely, social influence, facilitating conditions, expected effort and performance, as well as the constructs of hedonic motivation and habit as the antecedents of behavioural intention and user behaviour (Ain *et al.*, 2016). Researchers have used the UTAUT model to examine the influence of the aforementioned constructs on electronic systems acceptance, adoption of broadband Internet, e-prescribing technology acceptance, e-governance, social network adoptions, and e-learning systems (Ain *et al.*, 2016).

UTAUT is considered a recent instrument and is believed to synthesise eight known models of acceptance, including the Theory Acceptance Model, Combined Theory Acceptance and Theory of Planned Behaviour, Innovation Diffusion Theory, the Motivation Model, the Model of PC Utilization, and the Social Cognition Model (Yoo and Han, 2013; Venkatesh *et al.*, 2003). UTAUT is driven by eight constructs, namely, self-efficacy, social influence, anxiety, effort expectancy, facilitating conditions, performance expectancy, behavioural intention to use, and attitudes towards using technology (Yoo and Han, 2013).

Unified Theory of Acceptance and Use of Technology (UTAUT) is used to analyse and predict the behavioural intention of employee technology acceptance in the organizational context. The first version of UTAUT included four parameters; performance expectancy, effort expectancy, social influence and facilitating conditions. Performance expectancy is defined as the degree of getting benefits from performing certain activities; effort expectancy is defined as the degree of using technology easily or not; social influence is defined as the degree of the norms influencing usage behaviour from the referents who is treated as important people for employee; facilitating conditions is a term defining the degree of perceived resources required to support to perform certain behaviours (Chang *et al.*, 2018).

#### 2.5.1.5 Model of E-Learning Uptake and Continuance of E-Learning in Higher Education Institutions

Pinpathomrat (2015) applied five different grounded theories to construct a model, which helps to investigate the uptake and continuance of e-learning in higher educational institutions. This model was implemented at a Thai university. It was seen that e-learning is not beneficial if it is not used by students (Pinpathomrat, 2015). Two diverse groups of factors were used to indicate two different scenarios – the uptake of e-learning and its continuity. For the uptake scenario, the factors used included performance expectancy, effort expectancy, social encouragement expectancy, facilitating condition expectancy, and learning consistency expectancy (Pinpathomrat, 2015). For continuity, the factors used included performance expectancy confirmation, effort expectancy likely to affect the continued use of e-learning, confirmation, social encouragement expectancy confirmation, facilitating condition expectancy confirmation, and learning consistency expectancy confirmation (Pinpathomrat, 2015).

To sum up, Ain *et al.* (2016) indicated that TAM and UTAUT have been applied extensively to study acceptance behaviour in relation to technology use. The studies used these models to discuss factors such as facilitating conditions, perceived usefulness, social influence and ease of use (e.g. Al-Shehri, 2010; Alenezi *et al.*, 2010; Al-Harbi, 2011a; Al-Rasheed *et al.*, 2014; Al-Asmari and Rabb Khan, 2014).

### 2.5.2 Discussion of Related Work on Students' Attitudes towards E-Learning

Preferences and interests vary from one student to another. Similarly, their perceptions of e-learning systems are likely to differ, as do their attitudes towards this new education approach. However, examining several case studies provides some insights into this issue.

Adewole-Odeshi (2014) conducted a study concerning students' attitudes towards the adoption of e-learning systems in South Western Nigerian Universities. The study focused on examining whether the factors of attitude, perceived usefulness, and perceived ease of use have positive effects on behavioural intention to use e-learning systems. The study found a significant relationship between the stated factors and behavioural intention to use e-learning systems (Adewole-Odeshi, 2014).

In addition to this, Tagoe (2012) conducted a study to assess students' perceptions of using e-learning systems to learn at the University of Ghana. The variables used in the study included: access to computers, perceived ease of use, perceived usefulness, prior computer experience, frequency of Internet use, and attitude. The significant factors for behavioural intention to use were identified as: access to computers, perceived ease of use, prior experience and perceived usefulness (Tagoe, 2012).

A study conducted by Almarabeh *et al.* (2014) focused on examining students' perceptions of e-learning as well as its acceptance at the University of Jordan. The factors studied included: perceived ease of use, perceived usefulness, attitudes towards using and the behavioural intention to use e-learning systems. The study confirmed that perceived usefulness, perceived ease of use and attitudes are the factors which have a positive influence on intention to use e-learning systems (Almarabeh *et al.*, 2014).

A study conducted by Park (2009) focused on the behavioural intention to use e-learning systems among students at Konkuk University's Seoul Campus. The factors identified included: system accessibility, self-efficacy, subjective norms, attitude, perceived ease of use and perceived usefulness. The study identified a number of factors which influence behavioural intention to use e-learning systems, such as attitude, self-efficacy, and subjective norm (Park, 2009).

Zabadi and Al-Alawi (2016) investigated students' attitudes towards e-learning at a university based in Saudi Arabia. Over 300 students participated, and a questionnaire was used for the data collection. In general, the learners displayed a positive attitude towards e-learning. Gender and technology skills were also found to influence their attitudes. This study was similar to previous research by Rhema and Miliszewska (2014), who used a sample of engineering students in Libya to investigate attitudes towards e-learning. The participants portrayed a positive attitude towards e-learning and acknowledged its benefits. However, unlike Zabadi and Al-Alawi (2016), the researchers found no significant gender differences in the learners' attitudes.

Based on the results of these studies, it is evident that many students view e-learning in a positive light. They recognise its benefits and are willing to use it in the completion of their studies. It also emerged that gender and the students' experience in the use of technology have a minimal impact on their attitudes towards e-learning.

#### 2.5.2.1 Summary of Related Work

Table 2-1 summarises the review process of the related models and theories, and the empirical research outcomes for the related work concerning the factors that influence the acceptance of e-learning systems in different geo-contexts. The evaluation summaries presented in Table 2-1 highlights the process of exploring numerous aspects relating to the acceptance of e-learning systems. The students' perceptions of e-learning systems acceptance have been investigated in several learning institutions around the world, and especially in Saudi universities. Uncovering perceptions is possible by utilising existing learning models and theories such as TAM, TPB, and UTAUT.

However, some areas related to the acceptance of e-learning systems have been neglected, especially the perceptions of the core stakeholders (i.e., the learners). For example, literature related to the Saudi Arabian context has mostly focused on the acceptance of e-learning in general and e-learning systems rather than the acceptance of gamified e-learning systems. Concerns have also been expressed about the effectiveness of certain learning theories in explaining students' attitudes towards e-learning. Moreover, researchers have put forward conflicting views about gender and several other factors that are believed to influence the acceptance of e-learning systems (Al-Shehri, 2010; Alenezi *et al.*, 2010; Al-Harbi, 2011a; Al-Rasheed *et al.*, 2014; Al-Asmari and Rabb Khan, 2014). This research will fill the gap which exists due to the lack of studies on the acceptance of gamified e-learning systems in Saudi Arabian universities.

*Table 2-1 Reviews of related work and the filtration of factors*

| Study \ Factors | Attitude Towards Behaviour | Subjective Norms | Perceived Usefulness | Perceived Ease of Use | Perceived Behavioural Control | Job Relevance | Image | Perceptions of External Control (PEC) | Computer Anxiety | Output Quality | Voluntariness of Use | Performance Expectancy | Effort Expectancy | Social Influence | Facilitating Conditions | Gender | Age | Experience in IT | Personal Innovativeness | Self-Management | Perceived Enjoyment | Habit | Trust | Computer Playfulness | Computer self-efficacy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (Davis *et al.*, 1989; Venkatesh and Bala, 2008) (TAM3) including the external variables. | | ✓ | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | ✓ | | | ✓ | | | ✓ | ✓ |
| Venkatesh *et al.* (2003) (UTAUT) | | | | | | | | | | | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | | | | | | | |
| Zabadi and Al-Alawi (2016) | ✓ | | | | | | | | | | | | | | | ✓ | ✓ | ✓ | | | | | | | |
| Chokri (2012) | | | ✓ | ✓ | | | | | | | | | | | | | | ✓ | | | | | | | |
| Al-Harbi (2011b) | ✓ | ✓ | | | ✓ | | | | | | | | | | | | | | | | | | | | |
| Al-Hujran *et al.* (2014) | | | | | | | | | | | | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| Badwelan *et al.* (2016) | | | | | | | | | | | | ✓ | ✓ | ✓ | | | | | ✓ | ✓ | | | | | |
| Masa'deh *et al.* (2016) | | | | | | | | | | | | ✓ | ✓ | ✓ | ✓ | | | | | | ✓ | ✓ | ✓ | | |
| Tagoe (2012) | | | | | | | | | | | | | | | | ✓ | ✓ | | | | | | | ✓ | ✓ |
| Attuquayefio and Addo (2014) | | | | | | | | | | | | ✓ | ✓ | ✓ | ✓ | | | | | | | | | | |
| Al-Adwan *et al.* (2013) | ✓ | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | |
| Ngampornchai and Adams (2016) | ✓ | | | | | | ✓ | | | | | ✓ | ✓ | ✓ | | | | | | | | | | | |
| Adewole-Odeshi (2014) | ✓ | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | |
| Lee *et al.* (2009) | | | ✓ | ✓ | | | | | | | | | | | | | | | | | | | | | |
| Ernst *et al.* (2013) | | | | | | | | | | | | | | | | | | | | | ✓ | | | | |
| Seifert (2004) | | | | | | | | | | | | | | | | | | | | | | | | | ✓ |
| Teo *et al.* (2014) | | | ✓ | | | | | | | | | | | | ✓ | | | | | | | | | | |
| **Identified Factors** | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | | | | | | ✓ | ✓ | ✓ | ✓ | | | ✓ | | | ✓ | ✓ |

Identified factors Factors excluded due to lack of data Factors excluded due to redundancy

From Table 2-1 there are 17 key empirical studies that were analysed and tabulated in terms of the factors that were studied, including the technology adoption models used. In total, the 17 studies involved 25 factors of technology adoption as highlighted in the top row of the table. However, not all factors needed to be including in the model of the current research due to various considerations including the need to include more relevant factors to the research, data availability on the different factors and redundancy of the factors among others. To this end, 12 factors out of 25 were initially selected to be included in to the current research. These include Attitude Towards Behaviour, Subjective Norms, Perceived Usefulness, Perceived Ease of Use, Image, Facilitating Conditions, Gender, Age, Experience in IT, Perceived Enjoyment, Computer Playfulness and Computer Self-efficacy.

## 2.6 Chapter Summary

In this chapter, a literature review focused on e learning, e-learning systems and gamification was presented. This chapter introduced the concept of e learning, which relates to learning delivered through electronic devices. E learning has contributed significantly to students' learning processes since the 1960s. E learning has been facilitated using e-learning systems and has enabled students to access online learning materials.

The computerisation of e-learning systems has led to various benefits, such as making educational material more accessible, making learning more appealing to students, facilitating high levels of flexibility in time and location, and saving travel costs for students. Nonetheless, there are barriers to the success of e learning systems, which can be personal, organisational or technical. E-learning systems have evolved from monolithic architectures and specific learning domains, to re-usable tools incorporated into learning systems; this makes them useful in any e-learning course. Finally, gamification, which is the process of gamifying e-learning systems, was described and its benefits were highlighted.

This chapter also presents the necessity of gamification which changes individuals' behaviour and has become a critical necessity in most contexts. In addition, different theories regarding motivation and playfulness were presented, including Self Determination Theory (SDT) and ARCS model.

The content of this chapter, accompanied with the next chapter, assists in understanding and finding factors that affect the acceptance of gamified e-learning systems by students in Saudi universities.

Several models and theories have been reviewed with the aim of describing students' attitudes towards the acceptance of e-learning systems. The review of the models focused on unveiling those factors which contribute to students' intention to accept e-learning systems. The related work used the models to highlight the common factors that affect students' intention to accept e-learning systems. These factors include, but are not limited to, perceived usefulness, perceived ease of use, subjective norm, attitudes, motivation, and facilitating conditions. For example, the technology acceptance model is used widely by researchers to establish the chain of relationships between two well-known factors, namely, perceived ease of use and perceived usefulness, and their effect on behavioural intention to accept e-learning. In addition, it been concluded that students' attitudes towards e-learning differ significantly. Several studies have been conducted in different universities, with all of them revealing that factors such as gender, attitudes, self-efficacy, subjective norm, perceived ease of use and perceived usefulness significantly influence behavioural intention to accept e-learning systems among students. The reviewed studies also highlighted a research gap, arising as a result of the limited research on gamified e-learning acceptance, especially in the context of Saudi Arabian universities.

# Chapter 3: The Research Framework

In the previous chapter, the literature review highlighted a number of factors influencing student behaviours towards acceptance of e-learning systems. In this chapter, a description of the construction of a framework for gamified e-learning systems using the factors identified in the previous chapter will be presented. The construction of the proposed framework was divided into four stages. The first stage was a review of models and theories related to technology acceptance, which will make it possible to collect affecting factors. TAM and UTAUT were chosen as the main sources of the factors. These two models were chosen because they have been applied to study acceptance behaviour related to technology use (Ain *et al.*, 2016). Many studies have utilised TAM and UTAUT to investigate students' acceptance of e-learning and there is agreement that these two models are very effective when it comes to investigating e-learning acceptance by students (e.g. Masa'deh *et al.*, 2016; Tagoe, 2012; Attuquayefio and Addo, 2014; Al-Adwan *et al.*, 2013; Ngampornchai and Adams, 2016). This is followed by the extraction of factors from previous studies, which have been investigated in the e-learning domain in Saudi Arabia and worldwide (e.g. Masa'deh *et al.*, 2016; Tagoe, 2012; Attuquayefio and Addo, 2014; Al-Adwan *et al.*, 2013; Ngampornchai and Adams, 2016). Afterwards, the identified factors are filtered to include only the related factors that affect students' acceptance of gamified e-learning in Saudi context. The unrelated factors were excluded, and the repeated factors were removed. The final stage involved grouping the synthesised factors into categories.

## 3.1 Construction of the Framework

A framework is defined as a network of linked concepts or items that can be modified based on certain requirements. The strength of a framework is that it is used to understand phenomena rather than to predict them (Jabareen, 2009; Chang *et al.*, 2013).

The main purpose of conducting the literature review of secondary research was to develop a framework by which factors affecting the intention of students to accept gamified e-learning systems in the Saudi Arabian context are identified. The study identified the factors based on related work, theories and models published in journals, books and conference papers. The construction of the framework involved four steps, as illustrated in Figure 3-1, which are elaborated as follows:

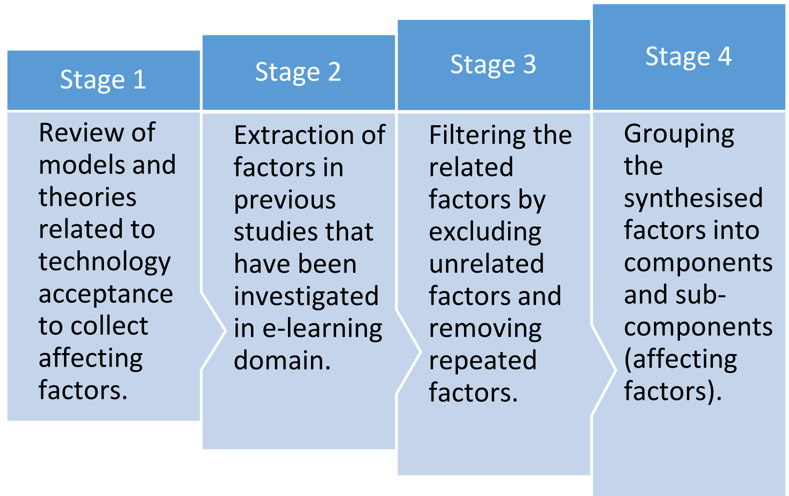


*Figure 3-1 The stages of the proposed framework construction.*

**Stage 1**: At this stage, many of the models used to study people's acceptance of IT were reviewed. This involves reviewing models and theories related to technology adoption to collect affecting factors. The focus was on reviewing widely-used models and theories describing the acceptance of information technology. Technology Acceptance Model (TAM) was one of the models that were reviewed in order to collect factors which influence people's acceptance of technology. Since this model has been developed into multiple versions, the researcher has studied all the versions which are TAM, TAM2, and TAM3. The review of TAM, TAM2, and closely TAM3 resulted in identifying essential factors that influence the acceptance of IT. Based on the review of models and theories, it was possible to identify affecting factors which contribute to the acceptance of technology with respect to e-learning systems (Masa'deh *et al.*, 2016; Tagoe, 2012; Attuquayefio and Addo, 2014; Lee *et al.*, 2009; Ajzen, 1991; Venkatesh *et al.*, 2003; Davis *et al.*, 1989).

**Stage 2:** This involves extracting the factors identified in the reviewed literature and analysing their significant influence on the acceptance of e-learning systems. The sources of the extracted factors were studied, while discussion was focused on students' perceptions of, and attitudes towards, e-learning systems in different universities. The studies were sourced from articles on students' perceptions of, and attitudes towards, the actual usage of e-learning systems at different universities. For example, the review of TAM3 resulted in extracting thirteen factors from which eight factors have been used to construct the framework. The eight factors which have been extracted are subjective norms, perceived usefulness, perceived ease of use, image, experience in IT, perceived enjoyment, computer playfulness, and computer self-efficacy.

**Stage 3:** In this stage, the factors collected during the previous two stages were filtered by removing repeated factors and excluding factors that shared the same concept, such as effort expectancy and social influence. For instance, effort expectancy was replaced by perceived ease of use, since both represent the same concept. The *effort expectancy* gives the same meaning of *perceived ease of use* but in reverse. Therefore, *effort expectancy* was removed whereas *perceived ease of use* was kept.

**Stage 4:** This stage involves the final representation of the construction process of the framework comprising the factors, which affect the acceptance of e-learning systems according to students in Saudi Arabian universities. This stage also involved grouping the synthesised factors into components and sub-components (affecting factors). The grouping process was conducted based on the meaning of the factors and their scope regarding the acceptance of e-learning systems. For instance, image and subjective norm were grouped in one category called social factors. This gathering was based on the extent to which the two factors are related to each other in terms of their relationship to a person's relationship with those around him/ her.

## 3.2 First Proposed Gamified E-Learning Systems Acceptance Framework (GELSAF1)

This section describes the meanings of the first proposed framework's categories and the factors that affect students' intentions to accept gamified e-learning systems. The proposed first version of the framework is organised into three main categories, as shown in Figure 3-2, namely, individual, system, and social factors. Each of these categories and its factors is discussed in the following sections.

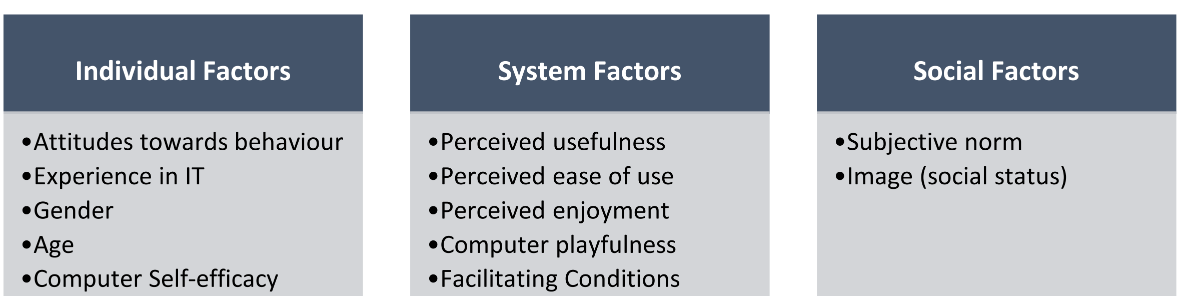


*Figure 3-2 Proposed Gamified E-Learning Systems Acceptance Framework (GELSAF1).*

This framework went through further steps of developments (see Figure 5-1 Comparison of the framework before and after expert reviews (GELSAF2)) and (see Figure 5-2 Comparison of the framework before and after students' questionnaire (GELSAF3)). Figure 5-1 shows the transformation of the framework after the analysis of the meeting of experts. Figure 5-2 shows the transformation of the framework after the analysis of students' questionnaire.

## 3.3 Individual Factors

This category includes all factors related to the individual. Students will communicate their attitudes towards the use of the system, their experience in IT, their gender, their age, their self-efficacy towards computers, and whether they enjoy using the system.

- **Attitudes towards behaviour**

This factor is defined as a person's feelings about performing a behaviour, be these positive or negative feelings (Fishbein and Ajzen, 1975). Yoo and Han (2013) indicated that attitudes towards behaviour represent the degree to which a user adopts a positive perspective, which in turn, affects the intention to accept e-learning systems. All previously-reviewed studies revealed that attitudes towards e-learning influence the intention to accept e-learning systems (Al-Harbi, 2011b; Zabadi and Al-Alawi, 2016). In this study, the attitudes towards behaviour factor was utilized in order to have a factor which through students' attitudes towards gamified e-learning systems can be examined.

- **Experience in IT**

This is defined as skills acquired through the use of computers and the Internet (Zabadi and Al-Alawi, 2016). The growth of ICT plays a critical role in students being able to gain more skills through the habitual use of computers and the Internet (Zabadi and Al-Alawi, 2016). The use of computers and the Internet equips students with the skills necessary to use e-learning systems easily (Zabadi and Al-Alawi, 2016).

"Your computer and the Net" is an experiment that was done by Mason and Weller (2000) which was performed on a large sample of students. The requirement of this course was to construct the assignments as HTML documents and submit them via Internet. After completing this experiment, it became clear to the authors that the following factors including skills of Web-creation, computer experience, group collaboration and time spending are essential factors affecting students' adoption of the distance learning. In this particular study, it is clear that having more experience in general web surfing was increasingly influential in e-learning adoption. This is because more experienced learners tend to be more familiar with various e-learning technologies which create more interest in such learners to engage in the practice compared to those which limited Experience in IT.

- **Gender**

In their paper Venkatesh *et al.* (2003), the attitude towards behaviour factor was found to be more salient for men, whereas subjective norm was more salient for women. Following their study, Gefen and Straub (1997) indicated that women and men have different perceptions of technology. Gender, as the results suggested, should be included as a factor when studying students' perceptions of IT acceptance (Gefen and Straub, 1997).

Within the context of Saudi Arabia, Al-Harbi (2011a) in the study *"e-Learning in the Saudi tertiary education: Potential and challenges"* examined the differences between the students based on their demographics to see if there is difference between male and female students regarding their intention to use e-learning. The results showed that male students were significantly different from female students in their intention to use e-learning. Male students demonstrated greater intentions to use e-learning than female students. Some of the reasons for the difference emanates from the fact that men are masculine individuals who tend to be assertive and would love to display higher technical skills particularly in technology fields compared to women.

Other studies on gender and technology adoption indicate that the effect of gender on technology adoption is highly moderated by age of the users. Studies by Morris *et al.* (2005), and Wang *et al.* (2009) confirm that the gender effect on technology adoption is moderated by age. In fact, the results indicate that the gender effect was more pronounced between young men and women. The effect becomes smaller as age advances. The literature therefore is inconclusive on the effect of gender on technology adoption.

- **Age**

Age has a considerable influence on the acceptance of e-learning. It is said that younger students show a higher level of acceptance of e-learning than older students (Teo *et al.*, 2014).

Many studies postulate that the reason why age is negatively correlated with new technology adoption is explained by the fact that older people tend to have higher computer anxiety which lowers the interest to adopt new technologies (Gefen and Straub, 1997). Moreover, further arguments on the age effect on technology systems' adoption are based on the belief that older people are less open to change compared to younger people (Chung *et al.*, 2010). On the other hand Venkatesh *et al.* (2000) found that younger people place greater importance on technologies as one of the strategies to be more employable which may not be a motivation factor for older people who may either be approaching retirement or already retired.

It is however critical to note that there are inconsistencies in the literature on the effect of age on technology adoption. For instance, a study conducted at the University of Ghana by Tagoe (2012) showed that age has no relationship with perceived ease of use. This reinforces the need to study it further.

- **Computer Self-efficacy**

Self-efficacy, or confidence, is an individual's judgement about whether he or she is capable of doing or performing a task at a specific level (Seifert, 2004). Students who believe that they are capable of performing tasks are likely to display adaptive behaviour. This is confirmed in the study of Madorin and Iwasiw (1999). In their survey Madorin and Iwasiw (1999), found that computer self-efficacy plays a critical role in technology adoption.

Bandura and Wessels (1997) argues that those who perceive themselves as capable of using IT equipment tend to base such perceptions on their mastery of computers skills which creates a positive outlook towards adoption of new technological systems. Nonetheless, in the study conducted by Al-Harbi (2011a) in the Kingdom of Saudi Arabia, it was concluded that in as much as computer efficacy impacts e-learning, the effect was small. This points to a contextual difference in the effect of computer efficacy. This inconsistency reinforces the need to study this factor further.

Therefore, in the current study, self-efficacy is used to investigate the extent to which this factor can affect students' acceptance of gamified e-learning systems. It is also anticipated that computer self-efficacy might be affected by the user's experience in IT. Users with more experience in IT, and specifically with computers, are more likely to have higher computer capability than users with limited experience.

## 3.4 System Factors

This category includes all factors that are related to the system itself, where students assess the usefulness, easiness, and playfulness that they experience when using the system.

- **Perceived Usefulness**

Perceived usefulness is defined as the level of enhancement of job performance that the individual believes he or she will achieve (Fishbein and Ajzen, 1975). It arises out of the belief that learning systems change a person's intention to accept the e-learning systems and also have a positive impact on their job performance (Davis *et al.*, 1989).

Catteddu and Hogben (2009) postulate that individuals and organisations consider the benefits and utility of the technology system before deciding to adopt it. Accordingly, Hsu *et al.* (2014) observes that there is a higher likelihood for individuals and organisations to adopt technology systems that promise more benefits compared to the costs involved in adopting such technology.

- **Perceived Ease of Use**

This is defined as the degree to which an individual believes that using a particular system would require no effort (Davis *et al.*, 1989). Similarly, Mtebe and Raisamo (2014) indicate that effort expectancy, also referred to as perceived ease of use, is the degree of ease related to the use of a system. Individuals perceive less complex systems as easy to use, and thus, these systems have a high chance of being accepted. This is corroborated by the findings of Venkatesh (2000) where it was discovered that technologies that require less physical and mental efforts to use, are always perceived to be easy to use and users are more likely to adopt them than those that require more efforts to use.

It is however critical to note that perceived ease of use is affected by the level of preparation given to the intended users. For instance, with better preparation, users are more likely to perceive technology systems as easy to use even when they are complex. Similarly, without proper preparation and training, users are likely to perceive even easy technologies are difficult to use. This therefore implies that there is a strong correlation between perceived ease of use and training. For example Hackbarth *et al.* (2003) found a strong correlation between ease of use and level of training users had received. On the other hand, ease of learning moderates the effect of perceived use of technologies on adoption of technologies. For instance, Davis (1989) found that users who were able to learn with ease were also able to perceive technologies as easy to use. This finding is critical for policy makers and institutional users of technologies as it reinforces the need to prepare learners and employees before new technologies or learning systems can be adopted to improve on their perceptions with regards to ease of use of the technologies. Moreover, such prior preparation creates the motivation and the enthusiasm to regard e-learning and technology systems as easy to use (Omer *et al.*, 2015).

- **Perceived Enjoyment**

This factor is defined as the extent to which using a system is perceived as being enjoyable, regardless of the performance consequences that result from the use of the system (Venkatesh, 2000). This factor is an indicator which makes it possible to establish whether or not the individual finds using the system to be enjoyable; this factor also indicates the actual usage process of the system, and whether it is fun to use the system (Venkatesh and Bala, 2008).

The theory of learning emphasises the need for motivation and particularly intrinsic motivation. Perceived enjoyment is a form of intrinsic motivation which has been found to impact individual decisions to adopt new technologies. To this end, systems including gamified learning models that add an entertainment orientation during learning or performance of a task increase the likelihood of adoption of such system (Merikivi *et al.*, 2016).

This factor, though critical to adoption of new technologies, has not been widely studied. Moreover, the fact that the current study is about a framework for gamified e-learning systems, makes this factor critical and confirms the need to investigate it more in the context of Saudi Arabia.

- **Computer Playfulness**

According to Venkatesh and Bala (2008), *"Computer playfulness represents the intrinsic motivation associated with using any new system"*. Playfulness has been used to study the motivational characteristics of human-computer interactions (Webster and Martocchio, 1992).

According to Kangas (2010) playfulness as applied in education is an approach to teaching and learning processes that entails the use of playful and physical activities that take place in a playful learning environment. Nørgård *et al.* (2017) indicate that there is growing disengagement and loss of motivation amongst students in institutions of higher learning due to poor pedagogy, stressful learning environment and disconnection between higher education curricular and reality among others. To this end, computer gameful approaches and techniques are increasingly being adopted to counter the challenges aforementioned. This therefore implies that where e-learning systems incorporate computer playful games, the likelihood for adoption of such a system will increase. Nonetheless, Deci *et al.* (2001); Boyle *et al.* (2016) warn that the benefits of playfulness to learning and teaching tend to be short term in nature and that the approach focuses mainly on extrinsic motivation through manipulation of the external environment which may actually diminish intrinsic motivation in the long run. To this end, caution needs to be taken particularly in the design of computer play activities to ensure that they influence both intrinsic and extrinsic motivation of learners and engagement for long-term benefits to be realised.

- **Facilitating conditions**

This refers to the degree to which an individual believes that the existence of an organisational and technical infrastructure will support the utilisation of the system (Masa'deh *et al.*, 2016). Yoo *et al.* (2012) indicated that facilitating conditions denote the amount of support students feel they are receiving in the organisation to adopt technology for work successfully. Users adopting a new technology have a strong belief that technical, organisational resources and managerial support facilitate the adoption of technology. Previous studies demonstrated that management support is one of the crucial and imperative factors contributing to the success of a complicated system (Al-alak and Alnawas, 2011).

In the case of gamified e-learning systems, facilitating conditions refer to the existence of an organisation's infrastructure support as well as an organisation's support of gamified e-learning systems where game elements and the game design context are fully adopted and built within the system.

It is imperative to understand that infrastructure needed to establish technology systems such as the gamified e-learning systems tends to be costly in terms of initial capital and maintenance. This is why some studies including Connor *et al.* (2014) have found cost to be negatively associated with new technology adoption. This therefore implies that organisations should first ascertain the infrastructural support required before adopting a new system.

- **Game Elements**

Experts in gamification highlight that only games that espouse particular elements or components or elements can result into better engagement and hence learning. de-Marcos *et al.* (2014) suggests that games that cause learning should have specific elements that include fun and reward. Jackson (2016) gives examples of game elements to include achievement or progression, rewards, story, time, personalisation and micro interactions.

Achievement is a critical game element because game players derive satisfaction from the level of accomplishment and skills developed. To this end, Jackson (2016) suggests that games should provide for points, badges, levelling, leader boards, progression bars and certificates to users. Rewards such as equipment, tools, collectibles, bonuses and power-ups are critical elements in gamification as they provide extrinsic motivation and recognition for the time, effort and skilled gained. Further, Jackson (2016) suggests that a story is another critical game element in that there is need to put a learning experience into a compelling narrative setting, add characters, create conflicts amongst them and draw the learner into the storyline. Time is another key element and according to Jackson (2016), games used for learning purposes should have a time element to create a sense of urgency and focus among the learners. Personalisation is also a game element that requires that effective games should have options for learners to personalise them either by changing look of the interface or by using a nickname during play. Finally, micro interactions matter in games for learning. Interactions can be in terms of animated rollovers, sound, subtle and cool transition screens among others. These increase the engagement of the learner.

- **User Interface Language**

Language is a critical element in any learning process. In most cases, learners learn better if the content they are being exposed to is in a language they fully understand. In other words, language aids understanding and completes the communication cycle. Equally, in e-learning systems, empirical research has proven that the user interface language and general user interface design of a particular system or application plays a critical role in enhancing or barring adoption of e-learning systems. Cho *et al.* (2009) in their study found that user-interface design positively impacts intention to use a new technology system, perceived ease of use and perceived system support. This implies that where the system's interface is in a language that is understandable, the users will be attracted to adopt it because they will think of it being easy to use particularly in individualised learning environments. Conversely, if the interface is in a language that is not understandable by the user, it will be most likely be perceived as difficult to use and not useful to the user and hence will be rejected.

## 3.5 Social Factors

This category includes factors related to the feelings of the student. What does the student feel about what others say about them using the system, and how would the student's social status be affected after the use of the system?

- **Subjective Norm**

According to Fishbein and Ajzen (1975) this factor is defined as the perception of a person considering the thoughts of the people most important to them when deciding whether or not to perform the behaviour. In other words, it is *"the perceived social pressure to perform or not to perform the* *behaviour"* (Ajzen, 1991). Moreover, social influence, also referred to as subjective norm, was found to be the degree to which an individual perceives the importance of other people believing that they have the ability to use a new system (Masa'deh *et al.*, 2016). Many people consider the importance of others' opinions when shaping their behaviours. Research studies have found mixed results regarding the impact of social influence on users' intention to accept and use e-learning systems. In their study investigating the adoption of internet banking, Shih and Fang (2004) found that subjective norms have multiple effects on one's intention to adopt particular behaviour. Foremost, subjective norms shape the attitudes of users towards adopting new behaviour.

The effects of subjective norms tend to be more significant in peer groups where the need to conform to conventional norms and behaviours is great. This therefore implies that if new systems such as gamified e-learning systems are to be introduced in a particular society, it is critical to understand the prevailing socio-cultural tensions that would enhance or limit its adoption. In the case of Saudi Arabia, the gamified e-learning systems have to fit into the cultural and religious fabric of society for them to be acceptable.

- **Image**

This factor is defined as *"the degree to which use of an innovation is perceived to enhance one's image or status in one's social system"* (Moore and Benbasat, 1991). Rogers (2010) emphasised that the desire to gain social status is an important factor in terms of whether individuals adopt innovations. In their study of the factors that affect older persons' to adopt assistive technologies, Mitzner *et al.* (2010) it was found that users tend to resist adopting technologies which stereotypes their image. For instance, old persons were found to resist technologies that create stereotypes and misconception about them in order to preserve their self-image.

This factor is critical as young persons (students) are very sensitive about their image and are more likely to associate with technologies and e-learning systems that elevate their image and social status inside and outside the university.

## 3.6 Chapter Summary

This chapter focused on identifying those factors which affect the acceptance of e-learning systems among students at higher education institutions. The chapter involved the process of framework development to identify the factors which contribute to the acceptance of e-learning systems. The development process began by reviewing relevant models and theories which contribute to the acceptance of technology; it also identified the factors addressed by the models and theories. In addition, a review of studies conducted at universities was carried out to identify the factors, which influence, and students' perceptions of, behavioural intention to accept e-learning systems. The process also involved an examination of several factors, which have a positive direct influence on behavioural intention to accept e-learning systems. These factors were based on technical, individual, organisational, and socio-cultural aspects.

# Chapter 4: Research Methodology Used in Confirming the Framework

In previous chapters, factors influencing the acceptance of e-learning were discussed, as well as the development of the GELSAF1 framework based on the identified factors. This chapter discusses the techniques used for the data analysis, and the complete research methodology is summarised in Figure 4-1. This chapter begins by discussing different research approaches, such as, qualitative methods, quantitative methods, and mixed methods, which were used in the confirmatory study for the GELSAF1 framework, in order to achieve the objectives of this research, which were presented in section 1.5. Secondly, the research methods employed in this study are provided in Section 4.2. Subsequently, a discussion of the potential research methods to be employed in the future directions of this research is provided in Section 5.3. A summary of the chapter is provided in Section 4.4.

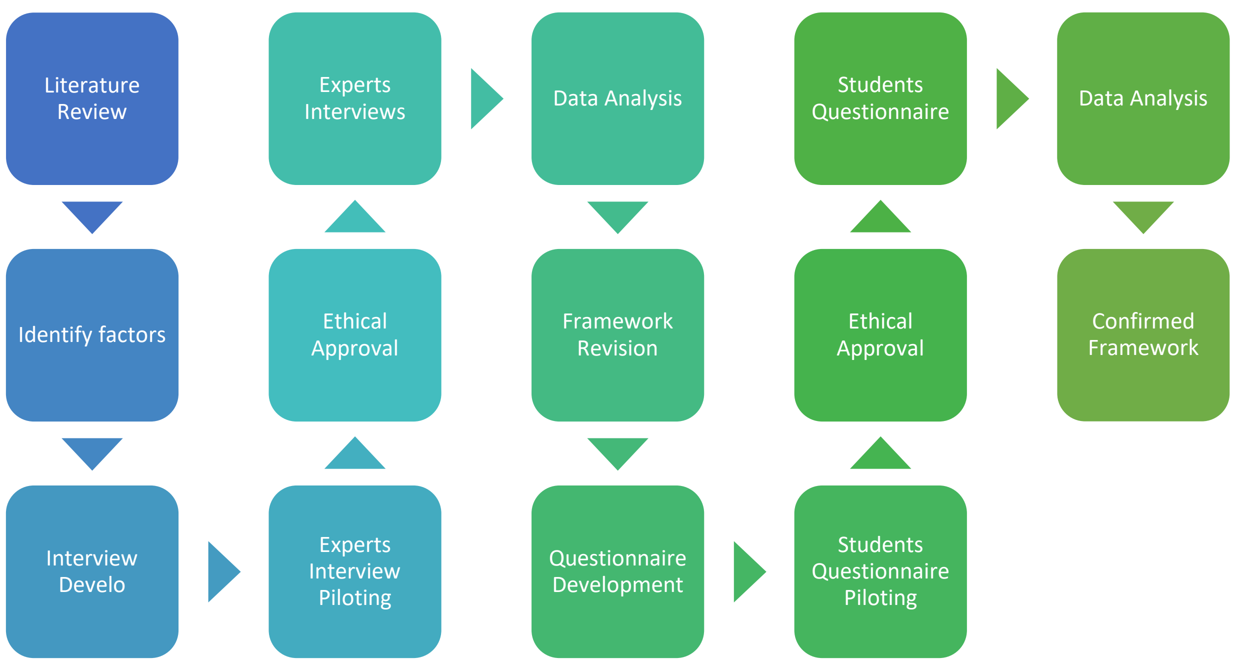


*Figure 4-1 Research Methodology Process*

## 4.1 Research Methods

As an essential part of any research, researchers propose research methods that they use to perform the data collection, analysis, and interpretation of the results obtained. Among the commonly used research methods are qualitative, quantitative, and mixed methods. For studies that deal with text or image data, qualitative methods are usually used; meanwhile, quantitative methods are usually used for studies that collect numeric data (Creswell, 2013). Some researchers use mixed methods, which involve both qualitative and quantitative methods (Recker, 2012).

### 4.1.1 Qualitative Methods

Qualitative research represents an approach for collecting, uniquely analysing, and drawing on different designs of various types of empirical materials such as text and image data, that are collected through interviews with open-ended questions, observations, and some other approaches that result in collecting data that is not easily reduced to numbers (Thomas, 2003; Creswell, 2013; Anderson, 2010). This investigative methodology is usually used when analysing and interpreting non-numeric data for the reason of understanding and interpreting specific phenomenon. This exploratory technique helps researchers understand under-investigation or in-question areas of research (Creswell, 2013; Thomas, 2003).

One of the strategies for collecting qualitative data is the interview. According to DiCicco-Bloom and Crabtree (2006); Sekaran and Bougie (2016), interviews are the most frequently used strategies for collecting qualitative data. In this research, face-to-face in-depth interviews with experts in e-learning and distance e-learning were used to collect confirmatory data to help validate the GELSAF framework.

For qualitative analysis purposes, Nvivo 11 software was used. Nvivo 11 is among different qualitative data analysis software such as QDA Miner Lite, ATLAS.ti, Quirkos etc. Nvivo 11 software was used because it provides some useful features such as importing and analysing emails, online surveys, spreadsheets, web data and much more. It also provides relationship coding as well as importing and creating of transcripts.

Nvivo was utilized as a tool that helped with organizing interviews transcripts and the open-ended surveys. Additionally, it helped with clustering sources by words contained in those sources. Nvivo was used, as well, to search for text and count words. In addition, it helped in grouping words using synonyms.

Every interview was recorded using an audio recording app on a Galaxy Note 5 mobile. Each recording went through speech to text process which was conducted by the researcher. This process included two steps: 1- converting the speech which was recorded to text; 2- because the interviews were conducted in Saudi Arabia and all the interviewees were Arab, discussions were conducted between the researcher and the interviewees in Arabic; therefore, translation of the text from Arabic language to English was required.

### 4.1.2 Quantitative Methods

Quantitative research is concerned with collecting, analysing, and interpreting numeric data that are collected through questionnaires, surveys, or by manipulating previous statistical data using computational techniques. This research method is used to explain a particular phenomenon (Babbie, 2013; Muijs, 2011). According to Creswell (2013), this research method is used in both surveys and experimental research.

When quantitative methods are adopted in a study, close-ended questions are commonly used. The participants have to specify their answers by choosing from the provided answers (Creswell and Clark, 2007). For the measurement purposes of the student questionnaire, a Likert scale was employed. The Likert scale is the most widely used scaling method, and is used to measure attitude or opinions directly (Likert, 1932). The Likert scaling method measures attitude or opinions by assessing the extent to which the participant agrees or disagrees with different opinion statements (Likert, 1932). The Likert scale contains different types of response category such as five, seven, and nine. The Likert scale used in this study is the Likert scale with the five-point scale which are “strongly agree”, “agree”, “neutral”, “disagree” and “strongly disagree”. Many previous studies used the five-point Likert scale because this type of measurement is readily comprehensible for respondents (Marton-Williams, 1986). Additionally, Revilla *et al.* (2014), agree that five-point scale provides higher value results than the 7-point and 11 -point scales.

### 4.1.3 Mixed Methods

A mixed method is a research approach with which researchers can use different types of research methods which are associated with both quantitative and qualitative data (Creswell, 2013; Recker, 2012; Farid *et al.*, 2018). The integration between qualitative and quantitative research can help establish the accuracy of both methods. In addition, the integration between these two types of research could help deliver more explanation for both types and explore various types of questions; qualitative research might explain quantitative and vice versa (Creswell, 2013; Recker, 2012). The strength of mixed methods is in its ability to enable researchers to answer confirmatory and exploratory research questions. In addition, it helps researchers in verifying and generating theories (Recker, 2012; Farid *et al.*, 2018). There are five major logical bases, according to Recker (2012); Creswell (2013), when employing mixed methods including:

- **Triangulation**: This is when the researcher seeks union or uniformity in the conclusions of the qualitative and quantitative methods, and seeks evidence that supports the results of a phenomenon using different methods and designs.
- **Complementary**: This is when the researcher seeks the completeness and perfection of results from one method with results from the other method.
- **Initiation**: This is when the findings of one method spark or initiate re-framed research questions that can be tracked using the different method.
- **Development**: This means that using findings of qualitative method to inform the findings of the quantitative method and vice versa.
- **Expansion**: This is used when the researcher is seeking to expand the range of the research by involving different methods for different research questions.

Different design strategies can be applied within mixed methods (Creswell, 2013) as summarised in Table 4-1.

*Table 4-1 Different strategies of mixed methods*

| Design Strategies | Characteristics | Purpose |
|---|---|---|
| **Sequential Explanatory** | Quantitative data collection and analysis along with subsequent of qualitative data collection and analysis | Use qualitative result to explain and interpret findings from the quantitative study |
| **Sequential Exploratory** | Qualitative data collection and analysis along with subsequent quantitative data collection and analysis | Useful when developing and testing an instrument that is used for exploring phenomenon |
| **Sequential Transformative** | Starts with collection and analysis of one of the qualitative or quantitative methods | Ensures which method is the best for serving the theoretical perspective |
| **Concurrent Triangulation** | Uses two or more methods to validate and confirm findings of data of a study that were collected synchronously | Strengthens weaknesses of one method by employing another method |

| Design Strategies | Characteristics | Purpose |
|---|---|---|
| **Concurrent Nested** | Guides the project by giving priority to one method, then imbedding or nesting another method | Investigates different questions apart from the influential ones or to find other levels |
| **Concurrent Transformative** | Guides all methodological choices by using a theoretical perspective that is reflected in the research questions of the study | Forms a value of a theoretical perspective at various levels of the data analysis |

## 4.2 Research Methods Employed in the Confirmatory Study of GELSAF1

This section provides details about the research approaches, which are used in this study to explore and confirm the identified factors constituting GELSAF. It provides a detailed overview of the triangulation method, which consists of three dimensions, which are literature review, expert interview, and student questionnaire.

### 4.2.1 Triangulation Technique

Triangulation is a metaphor for using multiple reference points for locating an object. This term is used in navigation and military strategies. In the world of research, however, triangulation is defined as using multiple methodologies to study the same phenomenon. This technique is usually used to ensure the accuracy of the results by collecting the data from multiple sources including investigators, methods, time and data to ensure its validity and credibility (Jick, 1979).

The research objectives of the confirmatory study are achieved by addressing the research questions through the use of the triangulation research method, which is *"philosophical positioning in the mixed methods community"* (Mertens and Hesse-Biber, 2012). Indeed, mixed methods such as the explanatory sequential mixed method, and the exploratory sequential mixed method are widely used by researchers to analyse data qualitatively and quantitatively (Creswell, 2013). These methods are used to interpret and analyse data collected through interviews, observations, surveys, or questionnaires to arrive at certain conclusions.

In this research, both qualitative and quantitative methods are used. After a critical literature review that identified different critical factors, which affect students' acceptance of gamified e-learning systems, expert interviews are performed, followed by a student questionnaire, as illustrated in Figure 4-2.

The triangulation process entails developing an investigation into groups of people, specifically two groups. The first group consists of educationalists such as e-learning experts, distance learning, and lecturers, while the second group includes students from different Saudi universities. The aim of the interviews was to assess whether the identified factors actually contribute to the acceptance of gamified e-learning systems and to discover factors not mentioned in the study. Open-ended questions were developed to assess the proposed factors, and all responses were recorded using a Sound Recording mobile application. The interviews were designed to collect as much information as possible from the identified experts, which were followed by a questionnaire designed for students to confirm the reviewed factors in the interviews conducted earlier.

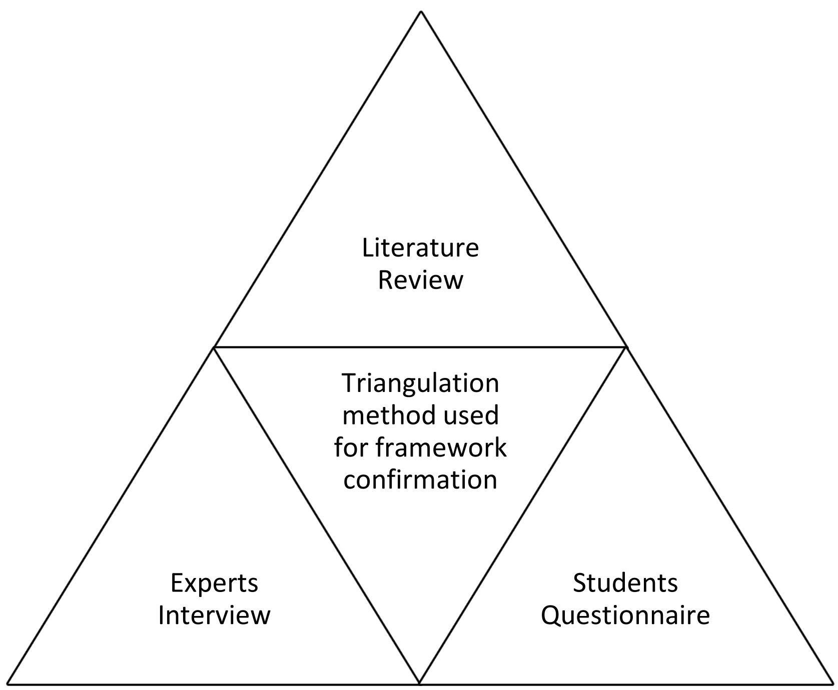


*Figure 4-2 Triangulation confirmation of the proposed framework (Denzin, 1973).*

### 4.2.2 Expert Interview

The reason behind using the qualitative research method in the form of interviewing experts is to validate the framework categories and their factors. The qualitative data interpretation and analysis results helped with the modification of the framework, e.g., removing, re-locating, and adding new factors. A total of 13 experts were interviewed. They all have experience in e-learning and distance learning. Each expert has more than four years of experience in using e-learning systems. The criteria used to classify the experts depended on the number of years of experience they have. Five years of experience and more was the standard that was used in selecting the sample of experts. The experts interviewed were from different universities in different regions in Saudi Arabia. A list of the participating experts' profiles in the study interviews is illustrated in Table 4-2.

*Table 4-2 Qualifications of Experts*

| Expert | Job Description and Experience |
|---|---|
| **A** | A Professor at Taif University. The Deanship of Computers and Information Systems. The Head of the Department of Computer Science for three years. |
| **B** | A lecturer at Prince Sattam bin Abdulaziz university, a Blackboard certified trainer, e-learning content designer, and a professional in LMS and VLE. |
| **C** | An assistant teacher at the Department of Computer at the Saudi Electronic University. An e-learning content designer and has a lot of experience with the Blackboard e-learning system. |
| **D** | A lecturer at the University of King Abdulaziz – Department of Distance E-learning and has more than five years of experience working with academic electronic systems such as training and e-learning systems. |
| **E** | A lecturer at the Northern Border University and one of the faculty members who has lots of experience in Blackboard e-learning system. |
| **F** | A lecturer at the Deanship of Computers and Information System at the University of King Abdulaziz. Has more than five years of experience using the Blackboard e-learning system. |
| **G** | A lecturer at Shaqra University – Department of Computer Science. Has lots of experience in e-learning systems and e-assessment. |
| **H** | A lecturer at King Saud University- Deanship of Computers and Information Systems. Has lots of experience in e-learning systems and e-assessment. |
| **I** | A lecturer at King Abdulaziz University - Deanship of Information Systems. Has more than five years of experience in e-learning practices and is an adaptive e-learning researcher. |
| **J** | A lecturer at King Abdulaziz University - Deanship of Information Systems. Has more than five years of experience in e-learning. |
| **K** | A lecturer at the - Deanship of Information Systems at King Abdulaziz University. Has more than four years of experience in e-learning. |
| **L** | A lecturer at Shaqra University and has more than 7 years of experience in e-learning systems (implementation, monitoring, and teaching). |
| **M** | A lecturer at King Abdulaziz University - Deanship of Information Systems. Has more than five years of experience in e-learning. |

- Expert Interview Design and Data Collection Procedures

In this research, semi-structured interviews were employed, which are characterised by both opened and closed-ended questions. In addition, the interviewer and the interviewees engage in a formal interview. Moreover, the interviewer in semi-structured interviews develops and uses an interview guide that includes questions and topics that interviewees should comment on in a specific order (Cohen and Crabtree, 2006). The interview guide provides the researcher with a collection of instructions for the interviewer and can provide credible and comparable qualitative data (Cohen and Crabtree, 2006). Semi-structured interviewing is recommended when the researcher has only one chance to interview someone (Cohen and Crabtree, 2006). The semi-structured interview is useful as it provides the researcher with a strong understanding of the topic (Cohen and Crabtree, 2006).

In this confirmatory study, the process of expert interviews involved several steps. First, every expert was asked via email about whether he or she wants to participate in the interview. After getting a confirmation of acceptance from the expert, he or she was asked to specify a preferred place for the meeting along with a preferred timing. After getting the approval of the meeting, meetings were arranged and conducted.

The interview contained 11 closed and open-ended questions that were presented to the experts in sequence. All the 11 questions were regarding the proposed factors. Each question was asked to the expert to know his or her judgment on the factors, each of which was linked to one question. Detailed discussion on the questions and the experts' suggestions are presented in Chapter 5.

During each interview session, the following procedure was followed:

- Welcoming and appreciation speech for each participant.
- Explaining and providing a brief introduction about the study objectives.
- Asking the expert to read the participant information sheet and sign off the consent form.
- Discussing and responding to the proposed factors and the framework categories and recording all the responses via a Voice Recorder mobile application.
- Finalising each interview session with warm thanks.

- Interview Piloting

Prior to the actual meetings with the experts, a trial or pre-test (piloting) interview was conducted. The objective of the pre-test, according to Fink (2003), is to test an instrument and ensure that it is accurate before it is used in real-life situations. Pre-tests help to ensure that the interview questions are faithful to the research context. For the pre-test, 10 or more capable testers are needed (Fink, 2003). The testers used for this pre-test were lecturers at different universities in Saudi Arabia, with good experience in e-learning and e-learning systems. Their suggestions were useful in modifying some statements and instructions to ease the reader's understanding. Due to the bilingual (Arabic and English) design of the instrument, some of the pre-test participants amended the Arabic translation of the instrument's items to make the item statements identical in both languages.

- Expert Interview Sample Size

The sample size of the experts used for the interview was 13. The expert sample size was indicated based on non-probability sampling were the researcher selects the sample based on his or her purposive personal judgement. When applying non-probability sampling techniques, the process of gathering the samples should give unequal chances to the samples to be selected (Bhattacherjee, 2012). Indeed, there is no agreement on how many interviews have to be completed in order to validate qualitative research; however, the number of the sample size used in this research is appropriate, according to some experts in the field of qualitative research (Baker *et al.*, 2012). For example, Harry Wolcott[8], responded to the following question "*How many qualitative interviews is enough?*" Baker *et al.* (2012), he stated, "*the old rule seems to hold that you keep asking as long as you are getting different answers,*" which means that when you get the same responses and you start having data saturation, you should stop seeking new answers. Data saturation is achieved when the researcher starts getting the same answers for a particular question every time he or she asks the same question (Marshall *et al.*, 2013). Regarding this exploratory study, the saturation of data occurred when the researcher reached the thirteenth expert.

- Expert Interview Qualitative Analysis

A combination of quantitative and qualitative approaches was used in the data analysis of this research. For the qualitative data analysis, thematic analysis method was employed. The thematic method is defined as a method that identifies, analyses, and reports patterns or themes within data, and is used for organising and describing data in full detail (Braun and Clarke, 2006). The thematic method can be used for interpreting different features of the research topic and summarising a collection of data collected for the research, in a specific way which can lead to locating important elements that can help in producing effective questions (Braun and Clarke, 2006; Aronson, 1995). Clearly, thematic analysis involves the search for and identification of common threads that extend across an entire interview or set of interviews (DeSantis & Noel Ugarriza, 2000).

In this study, the experts were asked questions related to different aspects of acceptance of gamified e-learning systems. Theme and sub-theme analysis were used, where theme analysis was related to the main aspect, which is the acceptance of gamified e-learning systems, and sub-theme was used for any related aspects.

[8] One of the pioneering qualitative researchers

For analysis purpose, Nvivo 11 software was used to examine the themes of the collected data. Nvivo 11 provides a helpful technique which gives a way to present every category of the framework as a node, and each factor within each category to be either "confirmed", "additional", "overlapped" or "irrelevant". The next step was coding and assigning data results from the transcript to the relevant nodes (see Table 5-1).

### 4.2.3 Student Questionnaire

Following the expert interviews, the framework was re-designed based on the expert suggestions and all the modifications recommended by them were applied to the student questionnaire. After the completion of the questionnaire development, it was distributed to students studying in different Saudi universities. The questionnaire was sent to students in order to confirm the reviewed framework. Questionnaires, according to Recker (2012), have the ability to confirm and quantify the results of quantitative research. In the questionnaire, the respondents were directed to answer questions based on a set of pre-specified answers. The student questionnaire was used in this study to collect data that was not detected or discovered such as the opinions of students and unobservable large population data. The questionnaire allowed students to answer the questionnaire's questions at their own convenience (Bhattachejee, 2012).

- Students Questionnaire Content Design

The questionnaire was created using Google Forms[9], which made it easier and faster to share with students. The questionnaire consisted of five sections. The first section included a welcoming message along with some instructions. It also included a participation agreement button; all the participants had to consent to participate in the questionnaire, otherwise they are taken to section five which included an appreciation message. The second, third, and fourth sections represented the body of the questionnaire, which consisted of the questions about the reviewed factors. All the participants were students in a variety of Saudi universities.

- Student Questionnaire Minimum Sample Size

The qualitative research sample size requires some pre-calculated parameters. There are three different parameters. First, type of error (α) – also known as error of the first kind – is when the null

[9] https://www.google.co.uk/forms/about/

hypothesis (i.e., the hypothesis where there are no significant differences between two population groups) is true but at the same time is rejected. The second type of error (β) – also known as error of the second kind – is when the null hypothesis is false but is not rejected, and lastly, the power (1-β). The first type of error (α) and the second type of error (β) decreases as the sample value increases (Banerjee *et al.*, 2009). Type I errors (α) are conventionally set to 0.05 for 95% confidence, while Type II errors (β) are conventionally set to 0.05 in order to have a power (1-β) of 0.95 of missing association. To calculate the minimum sample size for this study, G* Power software was utilised. G* Power provides researchers with various tools that help them determine sample sizes and more. In this research, G* Power was used to calculate the sample size used in one sample *t-test* with a type of power analysis; a priori (see Faul *et al.*, 2007), where sample size – given α, power, and effect size are required. Regarding the effect size d, according to Cohen (1992), exploratory studies use a large effect size (d = 0.80 - large). The calculated value as a minimum sample size considered in this study is 23, which results from calculating all the aforementioned values. A screenshot of G* Power with the adopted values is shown in Table 4-3.

*Table 4-3 Sample size according to G*Power software*

| Statistical Test | Means: Difference from constant (One sample test) | |
|---|---|---|
| Tails | Two | Input |
| Effect size (d) | 0.8 | |
| Type I: Error probability (α) | 0.05 | |
| Type II: Power (1– β error probability) | 0.95 | |
| Minimum sample size | 23 | Output |

- Student Questionnaire Trial

Prior to sending out the questionnaire to students, a piloting test was conducted. Twelve experts who have good experience in e-learning and distance learning helped in validating the questionnaire. The purpose of conducting such piloting test is to confirm that the questionnaire is well designed and constructed and clear enough to the students so they can give the right answers. To perform such piloting test, ten or more testers are needed (Fink, 2003). The testers of the questionnaire helped in simplifying questions and modifying the question presentations and constructions.

- Student Questionnaire Quantitative Data Analysis

Many quantitative data analysis tests exist. In this study, the statistical one-sample t-test and Cronbach’s alpha were used to analyse the quantitative data for its reliability and robustness as well as for a comparison between the data that was gathered against the expected outcomes. Cronbach's alpha test provides an estimation of data reliability by using all the variance and covariance information of the data. It also provides a test that is used to ensure that all the respondents understood all the questions provided in the questionnaire. In addition, Cronbach's alpha test helps in measuring the internal consistency of the collected data (Zeller and Carmines, 1980; Cronbach and Shavelson, 2004).

The t-test helps in assessing the mean value of data distribution. In order to perform one sample t-test on the collected data, a test value needs to be established beforehand. The test value used when performing the quantitative data analysis was three, which represents the neutral level value in the scale used, which was Likert 1 – 5 scale. The Likert scale used here is the scale with five levels of values, and the students have to choose one and only one of them. The values of the scale employed in the questionnaire were "Strongly Agree", "Agree", "Neutral", "Disagree", "Strongly Disagree", with the value decreasing from 5 for "Strongly Agree" to 1 for "Strongly Disagree" (see Likert, 1932).

In this study, the typical hypotheses have to be measured using a One-Sample t-test (2-tailed) against a 95% confidence level and an accepted error rate ($\alpha$) of 0.05 (5%). Thus, the null hypothesis $H_0$ and the relevant alternative hypothesis $H_1$ are described as:

$\boldsymbol{H_0}$: There is no statistical mean difference from 3.0.

$\boldsymbol{H_1}$: There is a statistical mean difference from 3.0.

- **Development and translation of interview and questionnaire questions**[10]

Before developing question items for the two data collection tools, a literature review was undertaken to establish the extent to which other scholars have contributed to the subject under investigation with the ultimate intent of establishing the gaps that needed filling. This led to definition of the main information needed to be collected from participants to achieve the objectives of the study and or answer the research questions. This was followed by identification of the respondents to provide the information needed. Based on the information needed and the respondents to provide the information, a decision was taken to have two questionnaires - one for students and the other for lecturers/professors/teachers at the universities. Also, drawing from the information needed and the existing tools, a choice was made to design the students' questionnaire

[10] https://www.who.int/substance_abuse/research_tools/translation/en

with closed question items with response options on the Likert scale. On the other hand, an informed decision was taken to have an open questionnaire for the lecturers due to the need to collect more qualitative information from them, among other reasons.

Question items were developed for each of the two data collection tools deriving from research objectives/research questions, literature review and as well guided by the existing tools previously used on similar studies. Initially, question items were written in English and were moderated by subject experts to ensure clarity, sufficiency and alignment to the study objectives. After approval of the data collection tools by the supervisor(s) and the experts, the tools were adapted to the study population. This entailed translating the question items from English to Arabic and dealing with the sensitivities. To ensure that the tools remained conceptually equivalent, acceptable, and that they perform in the same way in the target population, forward-translations and back-translations methods were used. Forward translation was undertaken by an expert with comprehensive knowledge of English language but whose mother tongue is Arabic. Instructions were given to guide translation with the emphasis on conceptual rather than literal translations. The translated tools were reviewed by an expert panel with bilingual background to identify and resolve any inadequate expressions and concepts of the translation. The reviewed translated copy was given to a translator to undertake back-ward translation from Arabic to English language with the intent to compare resulting English version with the original English version before translation. This was an iterative exercise until a satisfactory version was reached.

The final translated tools were piloted among the intended population before rolling out the study to establish the adequacy of the tools and generate feedback on ambiguities, hard and irrelevant question items. Finally, deriving from feedback from the piloting exercise, the research tools were refined by discarding unnecessary or redundant questions, and rewording ambiguous question items.

## 4.3 Model Validation Research Methodologies

### 4.3.1 Reliability Test (Cronbach's Alpha)

It is important to ensure the reliability of multiple Likert questions in a survey or a questionnaire, which form an instrument or a scale. Therefore, it is recommended to utilise Cronbach's alpha, which is commonly used to measure the internal consistency of the test and to determine the scale reliability (Bryman and Cramer, 2002). Cronbach's alpha is also called "coefficient alpha", which was suggested by Cronbach himself, as there were other works on alpha by other authors (Cronbach and Shavelson, 2004).

### 4.3.2 Exploratory Factor Analysis (EFA)

Exploratory Factor analysis (EFA) is a group of statistical methods that aim to identify the underlying factor structure of relevant variables without forcing a preconceived structure on the outcome (Norris and Lecavalier, 2010; Suhr, 2006). Moreover, the main statistical procedure that factor analysis consists of is making information about the number of common factors underlying a set of measures available for use (Fabrigar and Wegener, 2011). EFA consists of a collection of statistical procedures, which are used to define the number of distinct construct that is evaluated by a set of measures (Fabrigar and Wegener, 2011).

### 4.3.3 Structural Equation Modelling (SEM)

Structural Equation Modelling (SEM) is a family of statistical methods that help in identifying the strength of the structural relationships associated with a set of variables. SEM is commonly used in different research areas, and in the social sciences in particular (Byrne, 2016). SEM contains a set of statistical methods that permit multifaceted relationships between one or more independent variables and one or more dependent variables (Byrne, 2016). The use of SEM in this research will help to validate statistical models (Hair et al., 2010). Hence, SEM will be used to validate the statistical model, which will be used to investigate the acceptance of gamified e-learning systems by students in Saudi Universities.

### 4.3.4 Structural Equation Modelling (SEM) Sample Size

A minimum number of 200 students will participate in the questionnaire; however, the number of sample size recommended by researchers (Sekaran and Bougie, 2016) is 10 times the number of the variables used in constructing the framework. In this research, a counter of 12 constructs is used; i.e., 12 x 10 = 120. However, the number of 200 participants will be used to avoid any incorrect measurement when performing EFA or SEM.

### 4.3.5 Confirmatory Study Ethics Approval

Prior to interviewing the experts or distributing the questionnaire to the students, it is necessary to ensure that the study adheres to the ethical requirements of research conduct at the University of Southampton. The ethical approval application forms were filled in and the University of Southampton's ethics committee granted the approval under reference number **ERGO/FPSE/ 27978.**

## 4.4 Chapter Summary

In this chapter, different research methods used by researchers, in conducting quantitative and qualitative research were discussed. Some of the different research methods include quantitative, qualitative and mixed research methods. The mixed method was adopted in this research in order to confirm the proposed framework and its factors. The triangulation technique, which is one of the different design strategies that can be applied within mixed methods, was used in this research. The dimensions of the triangulation method were a literature review followed by expert interviews and lastly student questionnaire. For the expert interview, semi-structured interviews with closed and open-ended questions were adopted. The questionnaire was close-ended and was distributed to students via an online platform. The data collected from the expert interviews were analysed using Nvivo 11 software and a thematic analysis was employed. IBM SPSS 24 software was used to analyse the data collected from the student questionnaire by employing different-tests, which are Cronbach's alpha, to test the reliability and robustness of the data, and one-sample *t*-test to assess the mean value of the data distribution. The next chapters will detail the findings and discuss the results.

# Chapter 5: Findings and Discussion of the Framework Confirmation

The confirmation of the proposed GELSAF framework was achieved in three main steps. The first step was the critical literature review, which was presented in Chapter 2. The second and third steps were the expert interviews and student questionnaires, which were elaborated in Chapter 4. In this chapter, the analysis of the findings from the expert interviews and student questionnaire results are presented.

## 5.1 Findings of the Interviews

To validate the framework, thirteen experts were interviewed. All the experts are from different universities in Saudi Arabia. They are all faculty members and each expert has more than five years of experience in using and managing e-learning systems. The selection of the experts was based on their qualifications and their university's region. The reason behind this is that universities in Saudi Arabia have students with different backgrounds and cultural identities. Therefore, different experiences will determine the factors that affect students' intention to accept gamified e-learning systems and will improve the robustness of the framework.

The invitations were sent to the experts via email and WhatsApp. Ten interview sessions were conducted face to face and three were conducted online using Microsoft Skype for Business. Before each interview, every expert received consent information, a consent form, and an interview sheet. Every expert had to sign the consent form to proceed with the interview; otherwise, the meeting immediately ended with thanks. The procedure of the events of every meeting was developed carefully. Each interview started with a welcome icebreaking process, which included a cup of tea. After that, the experts were asked about a brief of their experience in e-learning. Then the open-ended questions were asked to the expert one after the other. At the completion of the interview, a thank you message was sent to each expert.

The experts were given hard copies of the proposed GELSAF's factors, which are categorised into three categories, namely, "individual", "social" and "technical". Each expert was given a verbal explanation of each category and its factors and was asked to give his or her judgment on the importance of each category and factor in the GELSAF framework. Concerning the factors review process, the experts were asked the following question: *'To what extent do you agree that the following factors are important in affecting student intention to accept gamified e-learning systems at Saudi Arabian Universities'.* They were directed to respond with their in-depth judgment about each factor. The findings of the expert inputs are presented in the following sections.

### 5.1.1 Individual Category

This category consists of four factors, which are experience in IT, gender, age, and computer self-efficacy. The experts were asked questions about their opinions towards the following factors belonging to the Individual category:

**Attitude Towards Behaviour**

Do you think student attitude towards behaviour is a critical factor that can affect students to accept gamified e-learning systems?

All the thirteen experts agreed that this factor is influential, and that it is one of the most important factors that form the framework. For example, Expert M says that this factor is important since most of the students use games very often. In addition, Expert **I** stated, *"This factor is very important. If the students pay no attention towards the system, then there will be no acceptance."* Expert F mentioned that this factor is important and if students lack the intrinsic desire to use these systems then it would be difficult for anyone to make them use them, unless there is some kind of reinforcement.

**Experience in IT**

The experts were asked the following question to determine their opinions on experience in IT:

Do you think students with experience in IT will accept gamified e-learning systems more than those who have no experience?

Seven of the experts agreed that the experience in IT is one of the factors that affect students' attitude towards the gamified e-learning systems. Expert M stated, *"Yes, I would agree, most of the students use kinds of games that build up their experience such as the games that teach them how to code. Therefore, they can have fun and build up their experience. Therefore, when they have this experience, they will accept the gamified e-learning system more than those who are unexperienced. The only problem is that universities' students might be at the same level of experience so I would doubt this will be an effective factor."* Expert I emphasised that *"Yes, I agree. This factor is important.*

*Do you know that in 2016, about 38% of Saudi families had no computers in their houses? Furthermore, most of the students who come from those houses have no experience in using computers, or at least they have less experience than others!"* In addition, Expert E stated, *"If the student has no experience then he or she will struggle at the beginning."*

**Gender**

Do you think male students will accept gamified e-learning systems more than female students?

Regarding this factor, nine experts tended to disagree that gender will be a critical factor that might affect the students' acceptance of the gamified e-learning systems. Expert **I** stated that there will not be obvious differences between males and females, *"This is not an important factor since there will be slight difference between males and females"*. Additionally, Expert M said, "*No, this factor is not that important because there is no big variety of tendencies between males and females. For example, males like action games more than females but also there are some female students who like to play action games."* Expert L mentioned that, *"Regardless of gender, students who are more confident when using the computer are more likely to adopt new systems. Students who are familiar with PC video games will be more confident to accept the new system, especially, if they find a similar environment."* On the other hand, Expert E confirmed this by saying, *"yes, each gender needs some sort of game design".*

**Age**

Do you think *age* will be a critical factor that affects students' acceptance of gamified e-learning systems?

More than half of the interviewees (10) tended to disagree with the importance of this factor. Most of them agreed that there would be no big range of ages among the testing sample. Expert C stated that, *"There will be a slight difference between the ages of students".* Expert F agreed that this factor is not important, as each student has his or her interests, saying, *"This factor is not important even if we have different ranges of age. Each student has his or her own interest even with games".* Expert K stated that, *"This factor is not important. Most of the students are at the same range of age 18-25; however, some students might be older but not very often".* Expert L stated, *"Most people like games and like game-design; I think this won't be important!"*

**Computer Self-efficacy**

Are students who have computer self-efficacy willing to accept gamified e-learning systems?

According to 12 of the experts, computer self-efficacy is an important factor. Expert H agreed on the importance of this factor and suggests that experience in IT should be combined with this factor as computer self-efficacy is usually a result of the experience in IT that the students has. Expert F stated, *"Yes, this factor is important since the student has to deal with a computer to use the system. Most of the systems share the same concepts such as How to login or send a message, and so on."* Expert E believes that this is an important factor with confederation of changing the name of the factor.

### 5.1.2 Culture and Social Category

This category consists of two factors, which are subjective norm and image (social status). The experts' responses for the two related factor to this category are as followed:

**Subjective norm**

Do people important to students such as parents, teachers, and friends affect their acceptance of gamified e-learning systems?

Nine of the interviewed experts agreed on the importance of this factor. Expert M said, "Yes, people important to students can affect his or her decision". Expert K stated, "Yes, this factor is important. Parents and friends might affect a student's decision". Expert J stated, "Yes, people important to students would have an impact on them". Expert F said, "Yes, this factor is important. The reputation of the system is transferable if someone heard about the system and he or she likes it and believes that this system is beneficial, and then he or she will advise you to use it". Expert L is of the opinion that the most influential people to students in the university environment are their teachers.

**Image**

Are students willing to accept a gamified e-learning system if they believe it will give them a special social status?

Seventy five percent of the interviewed experts agreed on the importance of this factor. Some said that this factor could work with some students and some said this is natural to us as human beings. Experts L said, *"Students like to be famous inside the university; if the system provides them with tools that could draw attention to them, then they will like it."* Expert E believes that this is an important factor by stating that, *"Yes, this is an important factor since it will be a kind of engagement"*. Expert K stated, *"Yes, some students take social status very seriously."*

### 5.1.3 System Category

This category consists of five factors, which are perceived usefulness, perceived ease of use, perceived enjoyment, computer playfulness, and facilitating conditions. Experts' inputs are quoted for each identified factor in this category as follow:

**Perceived Usefulness**

Are students willing to accept gamified e-learning systems if they feel that the system is beneficial for their learning?

All experts agreed on the importance of this factor. Experts L said, "This factor is very important. When students feel that they are wasting their time on a system that is not useful to them, they will not be motivated and they will probably stop using it, unless they have another type of reinforcement!" Expert M said, "Yes, this factor is important as long as the student believes that he or she will gain some benefits from the system." Expert G emphasised the importance of this factor, saying, "Usefulness is a big motivation for students; when students believe that their use of the system pays off, they will accept and use it."

**Perceived Ease of Use**

Are students willing to use a gamified e-learning system if the system is easy to use?

All the experts replied "Yes" to this question. All of them believe that if the system is easy to use then there will be a high percentage of acceptance. Expert H went on to say, *"Most students like to use systems that are user-friendly; systems that are not user-friendly are mostly neglected!"* Expert M said, "*Yes, this factor is important. Probably, none will use the system if the system was difficult to use."* Expert I agreed on the importance of this factor by stating, *"This is very important. If the system is complicated, it will not be continued."* Expert E, F, K, and J all emphasise the importance of this factor as well.

**Perceived Enjoyment**

Are students willing to accept a gamified e-learning system if it is enjoyable?

Eleven of the experts agreed on the importance of this factor. Expert L said, "Enjoyment usually motivates students to continue using the system; so, if they feel that the system is going to be enjoyable, then they will mostly accept it. A regular e-learning system is dull and uninteresting because of the lack of game elements. Gamified e-learning systems will absolutely make a difference!" Expert F said, "When game elements are included within an e-learning system, students will be more motivated and will be happy to accept the system." Expert J said, "Yes I agree. Students will be more engaged."

**Computer Playfulness**

Are students willing to accept a gamified e-learning system if it is playful?

Eleven of the experts agreed on the importance of this factor. Expert A said, "Students have to be motivated intrinsically. These kinds of systems that involve game elements usually have their effects on students. I believe that most of the students will accept the system because of the existence of game elements." Expert I stated, "Yes, I totally agree. We have a mission to make grown-ups love learning. This will make it easier for us to achieve this. If the students are intrinsically motivated, then we do not have to force them to use the system." Expert J said, "Yes, I agree. Students will feel playfulness when using the system."

**Facilitating Conditions**

Are students willing to accept a gamified e-learning system if they find all the support they will need?

All the experts said "yes" to this factor. Expert A said, "A system without support for its features will be hard to deal with. Most successful systems enjoy great support." Expert M stated, "Support and infrastructure are very important. Students like to have fast computers, which they have access to, 24/7, as well as a good supporting team." Expert F said, "The system has to have all the support; what I mean is that, the system has to be supported inside the university, like when students use the system using the university's computers and has to be supported for the users who use the system from home. What I would like to say is that students will feel more engaged if they see all the support exists and is there for them when they need it."

*Table 5-1 Thematic analysis of the expert interview*

| Code | Theme |
|---|---|
| **Importance *** | This factor is important<br>There is a need for this factor<br>It is essential<br>Totally agree on the importance of this factor |
| **Unimportance **** | This factor is not as important as others are.<br>This factor is not important.<br>The framework would work without this factor. |
| **Game elements or gamification** | Game elements increase the students' engagement and enjoyment.<br>Students like to play more than study.<br>Involving gamification would be great idea.<br>Games used for education help students in keeping up with their curriculums. |
| **Culture & social** | People around the students reinforce their participation.<br>Saudi Arabia is multicultural.<br>Students have different opinions based on their background and culture. |
| **Playfulness** | More fun corresponds with more student acceptance.<br>If the student feels playful, he or she will certainly accept the system. |
| **Age** | Most of the students who study in Saudi University are at the same range of age, which is usually between 18 and 25 years old.<br>Students in Saudi universities, especially undergraduates, enrol in the universities after they finish high school at the age of 18 years old.<br>I do not think that age would be significant. |
| **Gender** | I have noticed no differences between male and female students<br>Nowadays, group divergences are very rare between male and female students. |

* Used to indicate wither the factor is important to keep in the framework.

** used to indicate whether the factor is not important thus needs to be omitted from the framework.

### 5.1.4 Additional Factors and Framework Reconstruction

In addition to all the proposed factors, the experts had some additional modifications, to the construction of the framework itself, and to the influencing factors. These modifications are discussed subsequently.

The experts suggested that two additional factors have to be added to the framework, which are game-elements and language.

**Game elements**

The experts agreed that this factor is very important. Game-elements as a factor will strengthen the framework and make it more suitable to investigate students' acceptance of gamified e-learning systems in particular.

**User interface language**

A new factor that has been suggested by the experts is user interface language. The experts believe that user interface language is important. One of the reasons behind the agreement on this factor is that most of the experts face some problems with their students regarding e-learning systems interfaces, as most of those systems in Saudi universities do not support multiple languages (i.e., they support Arabic language mainly).

Although there is considerable agreement among experts on what influences students' acceptance of e-learning, there are still some differences that may affect the outcome of these results. In the future, more and more experts will be working with enough time for experts to argue and explain in more. For now, the above results will be adopted as satisfactory results. It should also be noted that some data are difficult to measure in a timely manner (Farid *et al.*, 2018).

## 5.2 Result of the Questionnaire

In this section, the analysis of the questionnaire's results is presented. After the completion of the data collection process by interviewing the experts, and after constructing the questionnaire based on the suggestions of the experts, the questionnaire is sent to students via the Internet. The questionnaire drew attention of 145 male and female students in different Saudi universities; However, only one hundred and thirty-five decided to participate in the questionnaire. The questionnaire consisted of five sections. The first section was an introduction that included a welcoming message, some information regarding the research, some instructions as well as a consent form that must be signed online by ticking a check box. The participant had to click on the '*agree*' button before continuing to the next sections, otherwise, he or she would be taken to the fifth section, which contained a "thanks" message. The second section included general questions. The third and the fourth sections included questions about the reviewed factors.

### 5.2.1 Missing Data

Regarding missing data, three responses were missing from the questionnaire regarding two factors including UIL1 and UIL2. Two answers were missing concerning UIL1 and one answer was missing concerning UIL2. A natural value (mean = 3) was used to replace the missing data.

### 5.2.2 Demographic Information

The demographic information of the participants was used to filter the participants using a criterion in which only responses of students with experience in using gamified e-learning systems were counted as valid. The participants differed in their experience with gamified e-learning systems. The sample was scattered between three levels of: less than two years, two to five years, and more than five years. All the participants with no experience were eliminated. The next table presents the demographic information of the participants.

*Table 5-2 Demographic information of practitioners*

| **The university** | **Number of participants** | | **%** |
|---|---|---|---|
| | Inexperienced | Experienced | |
| Imam Muhammad ibn Saud Islamic University | 0 | 2 | 1.5 |
| Princess Nora bint Abdul Rahman University | 0 | 1 | 0.7 |
| Northern Borders University | 26 | 18 | 32.1 |
| Taif University | 9 | 17 | 19.0 |
| King Saud University | 0 | 2 | 1.5 |
| Umm al-Qura University | 8 | 0 | 5.8 |
| University of Bisha | 2 | 0 | 1.5 |
| University of Tabuk | 19 | 14 | 24.1 |
| Jazan University | 0 | 1 | 0.7 |
| Shaqra University | 13 | 1 | 11.7 |
| Other Universities | 0 | 2 | 1.5 |
| **Total** | 77 | 58 | 100 |
| | 135 | | |

### 5.2.3 Descriptive and Frequency Analyses of the Questionnaire

In this section, the descriptive and frequency analysis that were used to understand the responses are described. All the findings resulted from the questionnaire pertaining to the 13 factors, which affect the acceptance of the gamified e-learning systems presented in this section. As an explanatory sequential mixed method was used in this research, the proposed framework was firstly confirmed by the experts, and secondly, the questionnaire was used to confirm the experts' review outcomes. A five-point Likert scale was used to record the responses of the participants. The five levels of the Likert scale were labelled as: 'strongly agree', 'agree', 'neutral', 'disagree', 'strongly disagree', which were set to values from 5 to 1. SPSS 24 was used to analyse the collected data of the questionnaire. The analysis of the data is presented below in three sections linked to the categories of the framework.

#### 5.2.3.1 Individual Factors Descriptive and Frequency Analyses

The category of individual factors contains five factors (or constructs), which are attitude towards behaviour (ATB), gender (Gen), experience in IT (ITExp), computer playfulness (CP), and computer self-efficacy (CSE). Each factor is represented by one or more questions (or items), which are validated from prior research (see Table 5-3).

*Table 5-3 Items for individual category constructs*

| Construct | Item | Question | Reference |
|---|---|---|---|
| **Attitude towards behaviour** | ATB1 | Accepting gamified e-learning systems will be a good idea. | (Venkatesh et al., 2003) |
| | ATB2 | I am interested in using gamified e-learning systems. | |
| **Gender** | Gen | Please select your gender | |
| **Experience in IT** | ITExp | For how many years have you been using gamified e-learning systems? | |
| **Computer playfulness** | CP | How you would characterize yourself when you use gamified e-learning systems? | (Venkatesh and Bala, 2008) |
| **Computer self-efficacy** | CSE1 | I could complete the learning activity using a gamified e-learning system when there was no one around to tell me what to do as I go. | (Venkatesh and Bala, 2008; Venkatesh et al., 2003) |
| | CSE2 | I could complete the learning activity using a gamified e-learning system when I had used similar e-learning software before this one to do the same job. | |

Note: It is the items rather than the actual exact question wording have been validated by prior research

Regarding the individual category of the validated framework, participants were asked six questions as shown in Table 5-3, in order to gather some general information and collect their opinions about how much they agree or disagree with the provided factors. Forty percent (39.7%) of the participants where male students, whereas 60.3% of them were female students (Table 5-4).

*Table 5-4 Gender frequency*

| Construct | Item | The university | Number of participants | % |
|---|---|---|---|---|
| **Gender** | GEN | Male | 61 | 45 |
| | | Female | 74 | 54 |

Regarding the years of experience in IT, participants were asked "*How many years have you been using gamified e-learning systems*"? 22% of the participants indicated that they have less than two years of experience, 13% have experience of 2 to 5 years, 6% have experience of more than five years; whereas, 46% has no experience in IT hence they were asked to leave the questionnaire with thanks (see Table 5-5).

*Table 5-5 Experience frequency*

| Construct | Item | Experience | Number of participants | frequency based on experience (in years) | | | |
|---|---|---|---|---|---|---|---|
| | | | | None | <2 | 2 to 5 | >5 |
| **Experience in IT** | ITExp | Experienced | 135 | 77 | 31 | 18 | 9 |
| | | | | 57% | 22% | 13% | 6% |

Concerning the computer playfulness, participants' answers to the question *"*How you would characterize yourself when you use gamified e-learning systems?*"* the results of this question are provided in Table 5-6 below. The two highest values in the table amongst those who have experience in IT are 'fixable' with 21 participants followed by 'playfulness' with 17 participants. Whereas, 'spontaneous' with 11 participants and 'creative' with 9 participants.

*Table 5-6 Computer playfulness frequency*

| Construct | Item | Frequency | Percent | Valid Percent |
|---|---|---|---|---|
| **Computer Playfulness** | Never used GELS | 77 | 57.0 | 57.0 |
| | Spontaneous | 11 | 8.1 | 8.1 |
| | Fixable | 21 | 15.6 | 15.6 |
| | Creative | 9 | 6.7 | 6.7 |
| | Playful | 17 | 12.6 | 12.6 |

Concerning attitude towards behaviour, 42% strongly agreed that "*Accepting gamified e-learning systems will be a good idea*" supported by 40% who agreed that "*I am interested in using gamified e-learning systems.*" Concerning computer self-efficacy, 37% tended to agree with "*I could complete the learning activity using a gamified e-learning system when there was no one around to tell me what to do as I go.*" Moreover, 23% strongly agreed and agreed, "*I could complete the learning activity using a gamified e- learning system when I had used similar e-learning software before this one to do the same job.*" Table 5-7 shows the frequencies of computer playfulness (CP), attitude towards behaviour (ATB) and computer self-efficacy (CSE).

*Table 5-7 GELSF's individual category frequencies*

| **Construct** | **Item** | **Frequency (percent)** | | | | | **Total 100%** |
|---|---|---|---|---|---|---|---|
| | | Strongly agree (5) | Agree (4) | Neutral (3) | Disagree (2) | Strongly disagree (1) | |
| **Attitude towards behaviour** | ATB1 | 42.3 | 46 | 10.2 | 1.5 | 0 | 100% |
| | ATB2 | 42.3 | 40.1 | 13.9 | 2.9 | 0.7 | 100% |
| **Computer self-efficacy** | CSE1 | 26.3 | 37.2 | 29.2 | 3.6 | 3.6 | 100% |
| | CSE2 | 23.4 | 43.8 | 23.4 | 8.0 | 1.5 | 100% |

#### 5.2.3.2 Culture Factors Descriptive and Frequency Analyses

Culture and Social category consists of two factors, which are *subjective norms* and *image* (social status). These factors are used to measure the influence of the culture on the students based on four questions that were adopted from previous research; all the questions were already confirmed and were ready to be adopted. The *subjective* norms factor was represented by two questions: the first question was to collect positive feedback while the second question was a check question to ensure that all the participants were giving attention to the questionnaire and they provided valid and valuable data. Twenty three percent of the participants strongly agreed and agreed with "*People (parents, teachers, and friends) who influence my behaviour would think I should accept gamified e-learning systems*" while 46 chose to agree. Regarding the *image* (social status) factor, the participants showed 29% of agreement with the question: "*I think that students who accept gamified e-learning systems are getting better education than those who do not*". In addition, 57% of them strongly agreed and agreed, "*I think that students who will accept gamified e-learning systems will have a good social status among other students*". Table 5-8 shows the frequencies of the constructs and their items.

*Table 5-8 Culture and social category frequencies*

| Construct | Item | Frequency (percent) | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | Strongly agree (5) | Agree (4) | Neutral (3) | Disagree (2) | Strongly disagree (1) | |
| **Subjective Norm** | SN1 | 23.4 | 46 | 28.5 | 2.2 | 0 | 100% |
| | SN2 | 7.3 | 16.1 | 24.1 | 37.2 | 15.3 | 100% |
| **Image (social status)** | IMG1 | 29.2 | 29.2 | 27.7 | 11.7 | 2.2 | 100% |
| | IMG2 | 16.8 | 40.1 | 31.4 | 9.5 | 2.2 | 100% |

Each factor is represented by one or more questions (or items), which are validated from prior researches (see Table 5-9).

*Table 5-9 items for culture category constructs*

| Construct | Item | Question | Reference |
|---|---|---|---|
| **Subjective Norm** | SN1 | People (parents, teachers, and friends) who influence my behaviour would think I should accept gamified e-learning systems. | (Venkatesh and Bala, 2008) |
| | SN2 | People (parents, teachers, and friends) who influence my behaviour would think I should not accept gamified e-learning systems. | |
| **Image (Social status)** | Img1 | I think that students who accept gamified e-learning systems are getting better education than those who do not. | (Venkatesh and Bala, 2008) |
| | Img2 | I think that students who will accept gamified e-learning systems will have a good social status among other students. | |

#### 5.2.3.3 System Factors Descriptive and Frequency Analyses

The system category comprises six factors, which are *perceived usefulness*, *perceived ease of use*, *perceived enjoyment*, *facilitating conditions*, *user interface language*, and *game elements*. Like the other factors in the social and culture category, this category contains questions that were answered in a Likert scale from one to five; where five means ‘strongly agree’ and one means ‘strongly disagree’. Regarding perceived usefulness, more than 78% strongly agreed and agreed on the fact that “Gamified e-learning systems will allow me to accomplish learning tasks more quickly.” Whereas, more than 79% strongly agreed and agreed that “Accepting gamified e-learning systems will increase my learning productivity”.

Concerning perceived ease of use, 24% strongly agreed and 49% agreed with “Interacting with gamified e-learning systems does not require a lot of effort.” Meanwhile, 31% strongly agreed and 50% agreed with “I would find gamified e-learning systems easy to use.”

With regards to perceived enjoyment construct’s items, both received a high percentage of strong agreements of more than 40% and agreements of more than 37% for both questions which are “I would find using gamified e-learning systems to be enjoyable” and “I think the core feature of using the gamified e-learning systems is pleasant”.

Still regarding the facilitating condition factor, two items were provided to the respondents. The two items were *training courses* and *university infrastructure*. The first question, which was regarding training courses, stated, “Gamified e-learning systems training courses would be essential for me to accept the system”. This question received 70% in both agreements and strong agreements. The question regarding university infrastructure, which was “University infrastructure is important to me to accept gamified e-learning systems”, received 56% strong agreements and 30% agreements.

The game elements and user interface language factors were suggested by the experts, and these were included in the student questionnaire in order to confirm the framework. The game element construct consisted of two items and the results of the three items were mostly above the neutral. The first item, “The use of game elements in e-learning systems will make the use of e-learning systems more effective”, received more than 85% strong agreements and agreements. The second item, which is “The use of game elements in e-learning systems will make the use of e-learning systems more enjoyable”, was strongly agreed (40%) and agreed (43%) upon by students. Concerning user interface language, students were asked two question which were “I think I will accept gamified e-learning system more if they were presented in Arabic Language” and “I think I will accept gamified e-learning systems more if the default language was set to Arabic Language”. The positive responses to these questions where high: only 9% disagreed and strongly disagreed. Table 5-10 presents all the frequencies of the category of system constructs and their corresponding items.

*Table 5-10 System category frequencies*

| **Construct** | **Item** | **Frequency (percent)** | | | | | **Total 100%** |
|---|---|---|---|---|---|---|---|
| | | Strongly agree (5) | Agree (4) | Neutral (3) | Disagree (2) | Strongly disagree (1) | |
| **Perceived Usefulness** | PU1 | 27 | 51.8 | 15.3 | 5.1 | 0.7 | 100% |
| | PU2 | 33.6 | 46.0 | 12.4 | 6.6 | 1.5 | 100% |
| **Perceived Ease of Use** | PEoU1 | 24.1 | 48.9 | 20.4 | 4.4 | 2.2 | 100% |

| Construct | Item | Frequency (percent) | | | | | Total 100% |
|---|---|---|---|---|---|---|---|
| | | Strongly agree (5) | Agree (4) | Neutral (3) | Disagree (2) | Strongly disagree (1) | |
| | PEoU2 | 31.4 | 50.4 | 14.6 | 3.6 | 0 | 100% |
| **Perceived Enjoyment** | PEnj1 | 40.9 | 37.2 | 16.8 | 3.6 | 1.5 | 100% |
| | PEnj2 | 23.4 | 39.4 | 24.1 | 10.9 | 2.2 | 100% |
| **Facilitating Conditions** | FC1 | 36.5 | 34.3 | 22.6 | 6.6 | 0 | 100% |
| | FC2 | 56.2 | 29.9 | 9.5 | 3.6 | 0.7 | 100% |
| **Game Elements** | GE1 | 34.3 | 51.8 | 10.9 | 2.2 | 0.7 | 100% |
| | GE2 | 40.1 | 43.1 | 13.1 | 0.7 | 2.9 | 100% |
| **User Interface Language** | UIL1 | 41.6 | 26.3 | 28.5 | 2.9 | 0.7 | 100% |
| | UIL2 | 40.1 | 40.1 | 13.9 | 5.1 | 0.7 | 100% |

Each factor is represented by one or more questions (or items), which were validated from prior researches (see Table 5-11).

*Table 5-11 Items for system category constructs*

| construct | item | Question | Reference |
|---|---|---|---|
| **Perceived Usefulness** | PU1 | Gamified e-learning systems will allow me to accomplish learning tasks more quickly. | (Venkatesh and Bala, 2008) |
| | PU2 | Accepting gamified e-learning systems will increase my learning productivity. | |
| **Perceived Ease of Use** | PEoU1 | Interacting with gamified e-learning systems does not require a lot of effort. | (Venkatesh and Bala, 2008) |
| | PEoU2 | I would find gamified e-learning systems easy to use. | |
| **Perceived Enjoyment** | PEnj1 | I would find using gamified e-learning systems to be enjoyable. | (Venkatesh and Bala, 2008) |
| | PEnj2 | I think the core feature of using the gamified e-learning systems is pleasant. | |
| **Facilitating Conditions** | FC1 | Gamified e-learning systems training courses would be essential for me to accept the system. | (Venkatesh et al., 2003) |
| | FC2 | University infrastructure is important to me to accept gamified e-learning systems. | |
| **Game-Elements** | GE1 | The use of game elements in e-learning systems will make the use of e-learning systems more effective. | (Huang and Soman, 2013; Morford et al., 2014) |
| | GE2 | The use of game elements in e-learning systems will make the use of e-learning systems more enjoyable. | |
| **User Interface Language** | UIL1 | I think I will accept gamified e-learning system more if they were presented in Arabic Language. | (Cho *et al.*, 2009) |
| | ULI2 | I think I will accept gamified e-learning systems more if the default language was set to Arabic Language. | |

### 5.2.4 Analysis of the Proposed Factors using One-Sample *t*-Test

In this section, a quantitative data analysis of the proposed factors is provided. An analysis of the twenty questions that were presented to students regarding the proposed factors is shown in Table 5-12. In order to examine and evaluate the collected quantitative data, one-sample *t-test* with test value of three was used (Field, 2000; Kent State University, 2018). The factors were considered statistically significant if their significance level is less than the p-value (0.0025), which was calculated using the Bonferroni correction.

The Bonferroni correction is named after Carol Bonferroni (1892 – 1960); an Italian statistician. The Bonferroni correction was built based on a method that was proposed previously by Neyman and Pearson (1933) to help in making decisions in studies that involve repetitive sampling (Armstrong, 2014).

Nowadays, the Bonferroni correction is frequently used to adjust probability (p) values when making multiple statistical tests (Armstrong, 2014). The Bonferroni correction was calculated by dividing the alpha (α=0.05) by the number of the hypotheses, where each item represents a hypothesis, provided p-value = (α/n) and (0.05/20) ≈ 0.0025. If the p-value is less than or equal to alpha (α), then the null hypothesis is rejected.

Moreover, if the p-value is greater than alpha (α), then the null hypothesis is accepted. As shown in Table 5-12, SN2 has a significance level of 0.242, which is greater than the p-value; however, it is considered significant since it was included in the questionnaire as a check question which is supposed to result in an inverse value for the preceding item. Additionally, all the items are considered significant according to the significance levels presented in Table 5-12. According to the qualitative and quantitative analyses, all the factors are considered important and therefore they are retained as part of the framework.

*Table 5-12 Analysis of proposed factors using one-sample t-test*

| One-Sample Test | | | | | | |
|---|---|---|---|---|---|---|
| **Item** | **Test Value = 3** | | | | | |
| | **t** | **df** | **Sig. (2-tailed)** | **Mean Difference** | **Mean** | **Std. Deviation** |
| **Gender** | -57.462 | 136 | <.001 | -2.453 | 0.55 | 0.500 |
| **ITExp** | -24.609 | 136 | <.001 | -1.956 | 1.04 | 0.930 |
| **CP** | 16.754 | 136 | <.001 | 1.204 | 4.20 | 0.841 |

| One-Sample Test | | | | | | |
|---|---|---|---|---|---|---|
| Item | Test Value = 3 | | | | | |
| | t | df | Sig. (2-tailed) | Mean Difference | Mean | Std. Deviation |
| **CSE1** | 9.266 | 136 | <.001 | 0.788 | 3.79 | 0.996 |
| **CSE2** | 9.902 | 136 | <.001 | 0.796 | 3.80 | 0.940 |
| **ATB1** | 21.336 | 136 | <.001 | 1.292 | 4.29 | 0.709 |
| **ATB2** | 16.754 | 136 | <.001 | 1.204 | 4.20 | 0.841 |
| **SN1** | 13.663 | 136 | <.001 | 0.905 | 3.91 | 0.775 |
| **SN2** | -3.808 | 136 | <.001 | -0.372 | 2.63 | 1.144 |
| **IMG1** | 7.770 | 136 | <.001 | 0.715 | 3.72 | 1.078 |
| **IMG2** | 7.369 | 136 | <.001 | 0.599 | 3.60 | 0.951 |
| **PU1** | 13.903 | 136 | <.001 | 0.993 | 3.99 | 0.836 |
| **PU2** | 13.090 | 136 | <.001 | 1.036 | 4.04 | 0.927 |
| **PEoU1** | 11.488 | 136 | <.001 | 0.883 | 3.88 | 0.900 |
| **PEoU2** | 16.528 | 136 | <.001 | 1.095 | 4.09 | 0.775 |
| **PEnj1** | 14.315 | 136 | <.001 | 1.124 | 4.12 | 0.919 |
| **PEnj2** | 8.159 | 136 | <.001 | 0.708 | 3.71 | 1.016 |
| **FC1** | 12.712 | 136 | <.001 | 1.007 | 4.01 | 0.927 |
| **FC2** | 18.730 | 136 | <.001 | 1.372 | 4.37 | 0.858 |
| **GE1** | 17.920 | 136 | <.001 | 1.168 | 4.17 | 0.763 |
| **GE2** | 17.556 | 136 | <.001 | 1.199 | 4.20 | 0.799 |
| **UIL1** | 13.062 | 136 | <.001 | 1.051 | 4.05 | 0.942 |
| **UIL2** | 14.931 | 136 | <.001 | 1.139 | 4.14 | 0.893 |

### 5.2.5 Reliability Test of Questionnaire (Cronbach’s Alpha)

In this research, Cronbach’s Alpha was used to ensure the reliability of the items and to measure the factors in a reliable manner. Cronbach’s alpha test was done using SPSS software 24. As summarised in Table 5-13, Cronbach’s Alpha test value is 0.900, which indicated that there is an elevated level of reliability.

*Table 5-13 Reliability statistics of the items*

| Reliability Statistics | | |
|---|---|---|
| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
| 0.891 | 0.895 | 23 |

### 5.2.6 Independent-Samples T-Test for Gender

The independent sample test was used to reach a persuasive conclusion on whether gender is an effective factor for students to accept gamified e-learning systems. In this regard, the statistical analysis software SPSS 24 was used, specifically independent sample testing. This test provides a statistical analysis of data to reach a persuasive outcome as to whether there is a difference in results between two different samples or two different groups within a single sample (Norušis, 2006). The following tables show the mean values for both male and female groups, as well as the level of significance, which will be useful in predicting the importance of the gender factor.

*Table 5-14 Gender independent sample t-test for Equality of Means*

| Independent Samples Test | | | | | | |
|---|---|---|---|---|---|---|
| Item | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | |
| | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference |
| CSE1 | 1.091 | 0.298 | 0.021 | 135 | 0.983 | 0.004 |
| CSE2 | 2.711 | 0.102 | 0.122 | 135 | 0.903 | 0.020 |
| ATB1 | 1.346 | 0.248 | 0.217 | 135 | 0.829 | 0.026 |
| ATB2 | 0.600 | 0.440 | 0.067 | 135 | 0.947 | 0.010 |
| SN1 | 0.116 | 0.734 | 1.306 | 135 | 0.194 | 0.173 |
| SN2 | 6.006 | 0.016 | 1.983 | 135 | 0.049 | 0.385 |
| IMG1 | 0.089 | 0.766 | 1.545 | 135 | 0.125 | 0.284 |
| IMG2 | 1.885 | 0.172 | 1.430 | 135 | 0.155 | 0.232 |
| PU1 | 1.363 | 0.245 | 0.502 | 135 | 0.616 | 0.072 |
| PU2 | 0.451 | 0.503 | 0.691 | 135 | 0.491 | 0.110 |
| PEoU1 | 1.186 | 0.278 | 0.808 | 135 | 0.421 | 0.125 |
| PEoU2 | 3.254 | 0.073 | 0.911 | 135 | 0.364 | 0.121 |
| PEnj1 | 0.088 | 0.767 | 0.429 | 135 | 0.668 | 0.068 |
| PEnj2 | 3.133 | 0.079 | 0.354 | 135 | 0.724 | 0.062 |
| FC1 | 0.708 | 0.402 | 0.655 | 135 | 0.513 | 0.105 |
| FC2 | 0.119 | 0.731 | -0.016 | 135 | 0.987 | -0.002 |
| GE1 | 0.017 | 0.897 | 0.807 | 135 | 0.421 | 0.106 |
| GE2 | 0.462 | 0.498 | -0.023 | 135 | 0.981 | -0.003 |
| UIL1 | 0.098 | 0.755 | 0.697 | 135 | 0.487 | 0.113 |
| UIL2 | 7.508 | 0.007 | 0.077 | 135 | 0.939 | 0.012 |

As shown in , there is no significant difference between the mean values of both the male and female groups. Moreover, the significance level of all items is greater than the p-value of 0.0025, which indicates that there is no significant difference between the means of male and female students. Concerning the gender factor, the null hypothesis indicates that the results for the two groups are the same. Hence, the null hypothesis is accepted if the significance level is less than the p-value; however, the significance level for all the factors when independently analysed showed that there is no difference between the two groups.

## 5.3 Discussion of the Results

In this section, the two factors that were added to the framework, following the expert interviews, are discussed. We will also discuss the factor that needs to be moved to a different category. A discussion of the result of the quantitative data analysis is presented as well.

### 5.3.1 Discussion of Expert Review Results

The first step in constructing the research framework, GELSAF, was based on a literature review, which was discussed in detail in Section 3.1. The next two steps of the framework confirmation were expert reviews and a student questionnaire, which were introduced earlier in this chapter.

The experts suggested that the framework needs to be re-categorised as the factor, *computer playfulness,* needs to be moved from the *system factors* category to the *individual factors category*. In addition, they emphasised that *age* is not important and should be omitted from the framework. Figure 5-1 presents the construction of the modified framework. The *age* factor was removed as suggested by the experts, since most students in Saudi universities are within the same age range, which is between 18 to 25 years old. The *playfulness* factor was moved from the system factors category to the individual factors category.

| Individual Factors | System Factors | Social Factors |
| --- | --- | --- |
| •Age | •Perceived usefulness | •Subjective norm |
| •Gender | •Perceived ease of use | •Image |
| •Attitude towards behaviour | •Perceived enjoyment | |
| •Experience in IT | •Facilitating Conditions | |
| •Computer Self-Efficacy | •User Interface Language | |
| •Computer Playfulness | •Game-Elements | |

*Figure 5-1 Comparison of the framework before and after expert reviews (GELSAF2)*

As this research seeks to investigate the acceptance of gamified e-learning systems by students in Saudi universities, the framework is intended to investigate the effect of gamification on the acceptance of gamified e-learning systems by students implicitly; however, the suggestion of the experts was to investigate that explicitly by adding game elements as a factor in the framework.

In addition to all the confirmed factors discussed previously, the experts were asked if there were other factors that could be added to the framework to make it more robust and reliable. The experts suggested two factors, namely, *user interface language* and *game elements,* which were defined in Section 4.2.2.

The two factors were considered to be important and most of the experts suggested that the two factors could be used for greater prediction regarding the acceptance of gamified e-learning systems. Since the aim of this research is to add game elements to e-learning systems, it was necessary to include game elements as a factor. Additionally, from the point of view of the experts who are in field, and who engage with students who use e-learning systems, the user interface language factor was considered to be crucial and therefore should be added to the framework.

### 5.3.2 Discussion of Questionnaire Results

In this research, the questionnaire was used to complement the two dimensions used in the triangulation methods used in this confirmatory study, which are literature review and expert reviews. The analysis results of the quantitative data presented in Section 5.2.4 showed that all the three categories and their constructs influence the acceptance of gamified e-learning systems by students in Saudi Universities. After the statistical analysis, the following factors were confirmed: attitude towards behaviour, experience in IT, computer self-efficacy, computer playfulness, subjective norms, image (social status), perceived usefulness, perceived ease of use, perceived enjoyment, facilitating conditions, user interface language, and game-elements. All the confirmed factors are used to construct GELSAF3 as shown on Figure 5-2. The mean score of the results of the data analysis ranged between 3.62 and 4.38, which indicated that all the factors have a substantial effect on students' acceptance of gamified e-learning systems.

With respect to *gender*, the independent sample t-test concerning the *gender* factor showed that the gender significance level is greater than the p-value of 0.0025, which indicated that there is no significant difference between the mean values of both groups; males and females. Table 5-14 shows the Levene's Test for Equality of Variances and t-test for Equality of Means. Levene's Test for Equality of Variances gave a detailed overview of whether this factor is important as a key component of the framework. Hence, the significance level (2-tailed) for all the items indicates that there are no differences between the two groups, and thus, the gender factor is insignificant, and based on this conclusion the gender factor was omitted.

Regarding the experience in IT, based on the experts' review and the Onaway ANOVA analysis (see Field, 2000), the result of data analysis (see Appendix B) concerning this factor showed no significant difference between the mean values hence this factor was excluded from further analysis.

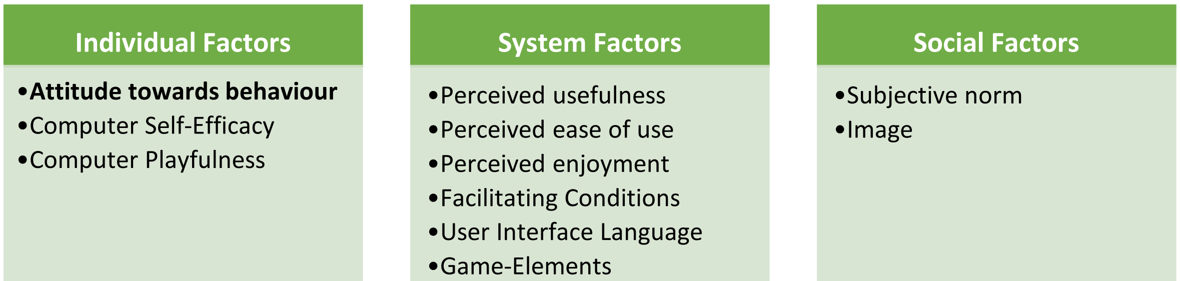


*Figure 5-2 Comparison of the framework before and after students' questionnaire (GELSAF3)*

## 5.4 Summary

To sum up, this chapter discussed the results of the quantitative and qualitative analyses of the expert interviews and the student questionnaire. The process of confirming the framework includes a semi-structured interview with the experts, which led to confirming the factors identified by the first method, which is the literature review. This process also assisted in identifying additional factors suggested by the experts. The process also informed the decision to move one factor from one category to another, include additional factors, and omit one factor, which was not considered significant. Afterwards, the reviewed framework (GELSAF2) was used as a basis to develop the questionnaire, which was then tested by 12 experts, in a piloting step. Subsequently, the questionnaire was distributed to students and data were collected. One hundred and thirty-five students were included as participants. The data collected were then analysed and the results indicate the confirmation of all the proposed factors in GELSAF2 except one factor (gender). Figure 5-3 shows the transformation of the framework from the first version GELSAF1 to the third version of the framework GELSAF 3.

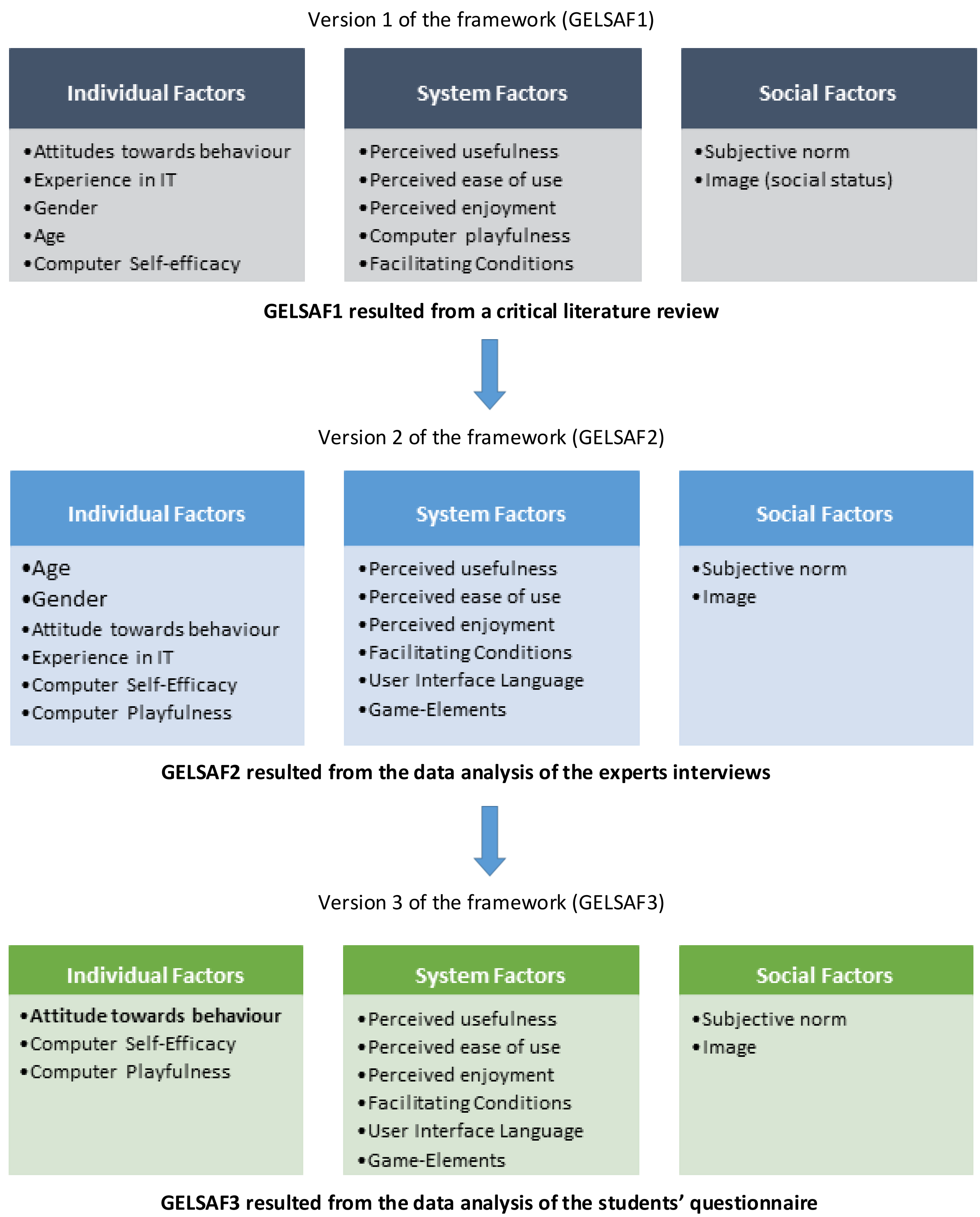


*Figure 5-3 Transformations of the framework*

# Chapter 6: Research Methodology of the Instrument and model development and validation

## 6.1 Preliminary analysis of data

This chapter relies on survey data collected from nine Universities in Saudi Arabia from 444 students from questions surrounding factors that are thought to influence the students' intention to adopt gamified e-learning systems. Before inferential analysis methods can be employed to arrive at conclusions, preliminary analyses are undertaken to explore the structure of the data and get initial proposals from the data collected. Particularly, preliminary analysis entails item evaluation and analysis, and item descriptive statistics. These statistics are key to providing prior information on the behaviour of data and its fitness for conducting further statistical analyses.

### 6.1.1 Missing data

There were no missing responses.

### 6.1.2 Item evaluation and analysis

In this study, two analytical techniques are applied to answer the research questions adequately – exploratory factor analysis (EFA) and structural equation models (SEM). According to Kline (1994), all measurement items that measure the latent variables (factors) have to fulfil particular psychometric properties in order to guarantee reliable results for factor analysis and structural equation modelling. In particular, items are expected to be internally consistent in measuring the factor and they should have normally distributed or symmetrical response patterns. Equally, item scales need to be optimally utilised by the respondents to ensure enough variations in responses. On the other hand, Schulz and Watkins (2007), state that suitable items to measure latent scales should be in position to contribute individually to the improvement in the reliability such that their exclusion from the analysis would compromise the reliability measure by lowering it.

In light of the above, data is first screened to check for compliance. To this end, the statistics of interest include the minimum and maximum response values (range), and Kurtosis and skewness measures. Kline (1994) provides a threshold value for Kurtosis as less than 2 while for skewness as less than 1. Kurtosis measures the frequency distribution of data around the mean and therefore it defines the shape of the normal distribution curve with regards to its narrowness or flatness. On the other hand, skewness measures the degree of concentration of responses in the tails of the normal distribution curve.

*Table 6-1 Item statistics.*

| Item | Label | N | Min | Max | Std. Dev | Skewness | Kurtosis | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|---|---|---|---|
| I see myself as spontaneous when I use e-learning systems | CP1 | 444 | 1 | 5 | 0.816 | -0.593 | 0.558 | 0.947 |
| I see myself as flexible when I use e-learning systems | CP2 | 444 | 1 | 5 | 0.806 | -0.630 | 0.328 | 0.947 |
| I see myself as creative when I use e-learning systems | CP3 | 444 | 1 | 5 | 0.844 | -0.444 | -0.012 | 0.947 |
| I see myself as playful when I use e-learning systems | CP4 | 444 | 1 | 5 | 0.913 | -0.734 | 0.253 | 0.947 |
| I see myself as unimaginative when I use e-learning systems | CP5 | 444 | 1 | 5 | 0.986 | -0.495 | -0.391 | 0.947 |
| I see myself as unoriginal when I use e-learning systems | CP6 | 444 | 1 | 5 | 1.098 | 0.202 | -0.715 | 0.949 |
| I see myself as uninventive when I use e-learning systems | CP7 | 444 | 1 | 5 | 0.967 | 0.939 | 0.714 | 0.951 |
| I am using gamified e-learning systems in learning | ITU1 | 444 | 1 | 5 | 0.865 | -0.661 | 0.256 | 0.947 |
| I intend to continue using gamified e-learning systems in learning | ITU2 | 444 | 1 | 5 | 0.923 | -0.880 | 0.860 | 0.946 |
| I frequently use gamified e-learning systems in learning | ITU3 | 444 | 1 | 5 | 0.958 | -0.597 | 0.007 | 0.946 |
| I intend to frequently use gamified e-learning systems in learning | ITU4 | 444 | 1 | 5 | 0.929 | -0.740 | 0.518 | 0.946 |
| I expect my use of gamified e-learning systems to continue in the future | ITU5 | 444 | 1 | 5 | 0.863 | -0.801 | 0.663 | 0.947 |
| I can complete the learning activity using a gamified e-learning system when there was no one around to tell me what to do as I go | CSE1 | 444 | 1 | 5 | 1.062 | -0.480 | -0.319 | 0.947 |
| I can complete the learning activity using a gamified e-learning system because I have used similar e-learning software before that does the same job | CSE2 | 444 | 1 | 5 | 0.908 | -0.432 | -0.136 | 0.947 |
| I can complete the learning activity using a gamified e-learning system because I saw someone else using it before trying it myself | CSE3 | 444 | 1 | 5 | 0.970 | -0.707 | 0.250 | 0.947 |
| I can complete the learning activity using a gamified e-learning system because I have the software manuals for reference | CSE4 | 444 | 1 | 5 | 1.047 | -0.616 | -0.267 | 0.948 |
| Accepting gamified e-learning systems is a good idea | ATB1 | 444 | 1 | 5 | 0.841 | -1.434 | 2.663 | 0.947 |

| Item | Label | N | Min | Max | Std. Dev | Skewness | Kurtosis | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|---|---|---|---|
| I am interested in using gamified e-learning systems | ATB2 | 444 | 1 | 5 | 0.879 | -1.062 | 1.336 | 0.946 |
| Accepting gamified e-learning systems have positive effects on the educational process | ATB3 | 444 | 1 | 5 | 0.846 | -1.126 | 1.362 | 0.947 |
| Gamified e-learning systems provide an attractive learning environment | ATB4 | 444 | 1 | 5 | 0.804 | -1.087 | 1.279 | 0.946 |
| People who influence my behaviour think that I should accept gamified e-learning systems | SN1 | 444 | 1 | 5 | 0.987 | -0.283 | -0.324 | 0.947 |
| Most of those who are around me think that I should accept gamified e-learning systems | SN2 | 444 | 1 | 5 | 0.910 | -0.215 | -0.270 | 0.947 |
| People who are important to me think that I should not accept gamified e-learning systems | SN3 | 444 | 1 | 5 | 0.957 | -0.380 | -0.212 | 0.947 |
| People whom opinions I value think that I should accept gamified e-learning systems | SN4 | 444 | 1 | 5 | 0.941 | -0.471 | 0.070 | 0.947 |
| I think that people who accept gamified e-learning systems are getting better education than those who do not | IMG1 | 444 | 1 | 5 | 1.054 | -0.600 | -0.292 | 0.946 |
| I think that people who accept gamified e-learning systems have good reputation | IMG2 | 444 | 1 | 5 | 0.974 | -0.141 | -0.593 | 0.947 |
| Accepting gamified e-learning systems is good for my reputation | IMG3 | 444 | 1 | 5 | 0.974 | -0.113 | -0.431 | 0.947 |
| Students in my university who accept gamified e-learning systems are known and more respected | IMG4 | 444 | 1 | 5 | 1.041 | 0.091 | -0.505 | 0.947 |
| Gamified e-learning systems allow me to accomplish learning tasks more quickly | PU1 | 444 | 1 | 5 | 0.802 | -0.593 | 0.178 | 0.946 |
| Gamified e-learning systems improve my learning performance | PU2 | 444 | 1 | 5 | 0.799 | -0.756 | 0.960 | 0.946 |
| I find gamified e-learning systems useful in my learning | PU3 | 444 | 1 | 5 | 0.738 | -0.859 | 1.590 | 0.946 |
| Accepting gamified e-learning systems enhances my effectiveness in learning | PU4 | 444 | 1 | 5 | 0.800 | -0.883 | 1.279 | 0.946 |
| Accepting gamified e-learning systems increases my learning productivity | PEoU1 | 444 | 1 | 5 | 0.817 | -0.637 | 0.210 | 0.946 |
| My interaction with gamified e-learning systems is clear and understandable | PEoU2 | 444 | 1 | 5 | 0.812 | -0.620 | 0.503 | 0.946 |
| I find gamified e-learning systems to be easy to use | PEoU3 | 444 | 1 | 5 | 0.833 | -0.632 | 0.505 | 0.947 |
| I find it easy to get a gamified e-learning system to do what I want it to do | PEoU4 | 444 | 1 | 5 | 1.021 | -0.177 | -0.954 | 0.947 |
| I find using gamified e-learning systems to be enjoyable | PEnj1 | 444 | 1 | 5 | 0.849 | -0.955 | 1.113 | 0.946 |
| The actual process of using the | PEnj2 | 444 | 1 | 5 | 1.057 | -0.357 | -0.518 | 0.948 |

| Item | Label | N | Min | Max | Std. Dev | Skewness | Kurtosis | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|---|---|---|---|
| gamified e-learning systems is pleasant | | | | | | | | |
| I have fun using the gamified e-learning system | PEnj3 | 444 | 1 | 5 | 0.796 | -0.622 | 0.110 | 0.946 |
| Gamified e-learning systems training courses are essential to accept the system | FC1 | 444 | 1 | 5 | 1.068 | -0.691 | -0.205 | 0.947 |
| University infrastructure is important to me to accept gamified e-learning systems | FC2 | 444 | 1 | 5 | 0.921 | -0.905 | 0.840 | 0.947 |
| I accept gamified e-learning systems because IT Staff are available for supporting | FC3 | 444 | 1 | 5 | 0.893 | -0.538 | -0.269 | 0.947 |
| The use of game elements into e-learning systems makes the use of e-learning systems more effective. | GE1 | 444 | 1 | 5 | 0.808 | -0.927 | 1.171 | 0.947 |
| The use of game elements into e-learning systems makes the use of e-learning systems more enjoyable. | GE2 | 444 | 1 | 5 | 0.800 | -0.934 | 1.074 | 0.947 |
| The use of game elements into e-learning systems makes me use gamified e-learning systems more than using non-gamified e-learning systems. | GE3 | 444 | 1 | 5 | 0.942 | -0.782 | 0.464 | 0.947 |
| The use of game elements into e-learning systems makes the use of e-learning systems more effective. | UIL1 | 444 | 1 | 5 | 1.075 | -0.540 | -0.384 | 0.949 |
| The use of game elements into e-learning systems makes the use of e-learning systems more enjoyable. | UIL2 | 444 | 1 | 5 | 1.001 | -0.981 | 0.625 | 0.948 |
| The use of game elements into e-learning systems makes me use gamified e-learning systems more than using non-gamified e-learning systems. | UIL3 | 444 | 1 | 5 | 0.985 | -0.641 | -0.125 | 0.948 |

From the analysis (see Table 6-1), there are 48 items that were responded to with an overall Cronbach alpha of 0.948, meaning that the questionnaire items are reliable at measuring the scales underlying the questionnaire. Only three items would improve the overall alpha if deleted. These are listed in the table below:

*Table 6-2 Items if deleted would slightly improve the overall alpha.*

| Item | Label | Cronbach's Alpha if Item Deleted |
|---|---|---|
| I see myself as unoriginal when I use e-learning systems | CP6 | 0.949 |
| I see myself as uninventive when I use e-learning systems | CP7 | 0.951 |
| The use of game elements into e-learning systems makes the use of e-learning systems more effective? | UIL1 | 0.949 |

From Table 6-2 above, if items CP6, CP7 and UIL1 were excluded from the reliability analysis, the overall alpha would increase from 0.948 to 0.949, 0.951, and 0.949 respectively. Nonetheless, the improvement in overall alpha arising from exclusion of each of the said items is negligible. Rather than excluding such items based on just a single criterion, these items are retained for further analyses lest they are further implicated for being unsuitable to measure the underlying scales.

With regards to the reliability of subscales, there are notable variations in reliability of the subscales where some subscales are more reliably measured compared to others (see Table 6-3 below).

*Table 6-3 Reliability measures for the sub-scales.*

| | **Computer Playfulness** | **Alpha** |
|---|---|---|
| CP1 | I see myself as spontaneous when I use e-learning systems | 0.584 |
| CP2 | I see myself as flexible when I use e-learning systems | |
| CP3 | I see myself as creative when I use e-learning systems | |
| CP4 | I see myself as playful when I use e-learning systems | |
| CP5 | I see myself as unimaginative when I use e-learning systems | |
| CP6 | I see myself as unoriginal when I use e-learning systems | |
| CP7 | I see myself as uninventive when I use e-learning systems | |
| | **Intention to Use** | **Alpha** |
| ITU1 | I am using gamified e-learning systems in learning | 0.873 |
| ITU2 | I intend to continue using gamified e-learning systems in learning | |
| ITU3 | I frequently use gamified e-learning systems in learning | |
| ITU4 | I intend to frequently use gamified e-learning systems in learning | |
| ITU5 | I expect my use of gamified e-learning systems to continue in the future | |
| | **Computer self-efficacy** | **Alpha** |
| CSE1 | I can complete the learning activity using a gamified e-learning system when there was no one around to tell me what to do as I go | 0.663 |
| CSE2 | I can complete the learning activity using a gamified e-learning system because I have used similar e-learning software before that does the same job | |
| CSE3 | I can complete the learning activity using a gamified e-learning system because I saw someone else using it before trying it myself | |
| CSE4 | I can complete the learning activity using a gamified e-learning system because I have the software manuals for reference | |
| | **Attitude towards behavior** | **Alpha** |
| ATB1 | Accepting gamified e-learning systems is a good idea | 0.854 |
| ATB2 | I am interested in using gamified e-learning systems | |
| ATB3 | Accepting gamified e-learning systems have positive effects on the educational process | |
| ATB4 | Gamified e-learning systems provide an attractive learning environment People who | |

| | | |
|---|---|---|
| | influence my behaviour think that I should accept gamified e-learning systems | |
| **Subjective norm** | | **Alpha** |
| SN1 | People who influence my behaviour think that I should accept gamified e-learning systems | 0.856 |
| SN2 | Most of those who are around me think that I should accept gamified e-learning systems | |
| SN3 | People who are important to me think that I should not accept gamified e-learning systems | |
| SN4 | People whom opinions I value think that I should accept gamified e-learning systems | |
| **Image** | | **Alpha** |
| IMG1 | I think that people who accept gamified e-learning systems are getting better education than those who do not | 0.821 |
| IMG2 | I think that people who accept gamified e-learning systems have good reputation | |
| IMG3 | Accepting gamified e-learning systems is good for my reputation | |
| IMG4 | Students in my university who accept gamified e-learning systems are known and more respected | |
| **Perceived usefulness** | | **Alpha** |
| PU1 | Gamified e-learning systems allow me to accomplish learning tasks more quickly | 0.876 |
| PU2 | Gamified e-learning systems improve my learning performance | |
| PU3 | I find gamified e-learning systems useful in my learning | |
| PU4 | Accepting gamified e-learning systems enhances my effectiveness in learning | |
| **Perceived ease of use** | | Alpha |
| PEoU1 | Accepting gamified e-learning systems increases my learning productivity | 0.74 |
| PEoU2 | My interaction with gamified e-learning systems is clear and understandable | |
| PEoU3 | I find gamified e-learning systems to be easy to use | |
| PEoU4 | I find it easy to get a gamified e-learning system to do what I want it to do | |
| **Perceived enjoyment** | | **Alpha** |
| PEnj1 | I find using gamified e-learning systems to be enjoyable | 0.654 |
| PEnj2 | The actual process of using the gamified e-learning systems is pleasant | |
| PEnj3 | I have fun using the gamified e-learning system | |
| **Facilitating conditions** | | **Alpha** |
| FC1 | Gamified e-learning systems training courses are essential to accept the system | 0.720 |
| FC2 | University infrastructure is important to me to accept gamified e-learning systems | |
| FC3 | I accept gamified e-learning systems because IT Staff are available for supporting | |
| **Game element** | | **Alpha** |
| GE1 | The use of game elements into e-learning systems makes the use of e-learning systems more effective? | 0.732 |

| | | |
|---|---|---|
| GE2 | The use of game elements into e-learning systems makes the use of e-learning systems more enjoyable? | |
| GE3 | The use of game elements into e-learning systems makes me use gamified e-learning systems more than using non-gamified e-learning systems? | |
| | **User interface language** | **Alpha** |
| UIL1 | I accept gamified e-learning system more because they are presented in Arabic Language | 0.423 |
| UIL2 | I accept gamified e-learning systems more because they are multilingual | |
| UIL3 | I accept gamified e-learning systems more because the default language is set to Arabic Language | |
| Alpha measures how consistent a group of items are at measuring an underlying construct. | | |

From Table 6-3 above, it is clear that whereas Intention to Use, Attitude towards behaviour, Subjective norm, Image, Perceived usefulness, Perceived ease of use, Facilitating conditions, and Game element have their alphas equal or above the recommended 0.7 (Panayides, 2013), four factors including Computer Playfulness (CP alpha=0.584), Computer self-efficacy (CSE, alpha=0.663), Perceived enjoyment (PEnj, alpha=0.654), and User interface language (UIL, alpha=0.423) have their alphas below the recommended 0.7. The worst reliability measures are noticeable for User interface language (UIL) and Computer Playfulness (CP) with their alphas far below 0.7. Some of the causes of the low alpha for the above four factors are poor correlation between the items and the fact that some items load on more than one construct which is an indicator of heterogeneous constructs (see Tavakol and Dennick, 2011). This implies that the measurement items do not reliably measure the two factors.

With regards to the item descriptive statistics and distribution statistics, all items have 1 as their minimum response value and 5 as their maximum response value, meaning that the response options were optimally utilised by the respondents. Concerning the distribution of the responses in each question item, only one question item ATB1 violates the provided thresholds for both kurtosis and skewness. To illustrate, whereas Kline (1994) provides for a threshold of less than 2 for kurtosis and less than 1 for skewness, ATB1 has -1.434 and 2.66 for skewness and kurtosis respectively. Other ATB measurement items including ATB2, ATB3, and ATB4 have skewed responses outside above 1, but fortunately their kurtosis values are within the accepted range.

In light of the above findings, it can be concluded that whereas some measurement items particularly those measuring ATB violate the normal distribution principle, the majority of the items are suitable for factor and SEM analyses. Also, two factors, CP and UIL, are not being reliably measured as indicated by lower alphas. At the moment, it might be early to take action of excluding the suspicious items and factors from further analysis, rather, it is prudent to keep such concerns in the purview of this analysis.

### 6.1.3 Item and factor descriptive statistics

*Table 6-4 item and factor descriptive statistics.*

| Computer Playfulness | | Mean | SD |
|---|---|---|---|
| CP1 | I see myself as spontaneous when I use e-learning systems | 3.91 | 0.816 |
| CP2 | I see myself as flexible when I use e-learning systems | 4.03 | 0.806 |
| CP3 | I see myself as creative when I use e-learning systems | 3.96 | 0.844 |
| CP4 | I see myself as playful when I use e-learning systems | 3.95 | 0.913 |
| CP5 | I see myself as unimaginative when I use e-learning systems | 3.75 | 0.986 |
| CP6 | I see myself as unoriginal when I use e-learning systems | 2.99 | 1.098 |
| CP7 | I see myself as uninventive when I use e-learning systems | 2.14 | 0.967 |
| Factor mean and SD | | 3.53 | 0.92 |
| **Intention to Use** | | **Mean** | **SD** |
| ITU1 | I am using gamified e-learning systems in learning | 3.90 | 0.865 |
| ITU2 | I intend to continue using gamified e-learning systems in learning | 3.96 | 0.923 |
| ITU3 | I frequently use gamified e-learning systems in learning | 3.70 | 0.958 |
| ITU4 | I intend to frequently use gamified e-learning systems in learning | 3.80 | 0.929 |
| ITU5 | I expect my use of gamified e-learning systems to continue in the future | 4.04 | 0.863 |
| Factor mean and SD | | 3.88 | 0.91 |
| **Computer self-efficacy** | | **Mean** | **SD** |
| CSE1 | I can complete the learning activity using a gamified e-learning system when there was no one around to tell me what to do as I go | 3.58 | 1.062 |
| CSE2 | I can complete the learning activity using a gamified e-learning system because I have used similar e-learning software before that does the same job | 3.76 | 0.908 |
| CSE3 | I can complete the learning activity using a gamified e-learning system because I saw someone else using it before trying it myself | 3.65 | 0.970 |
| CSE4 | I can complete the learning activity using a gamified e-learning system because I have the software manuals for reference | 3.69 | 1.047 |
| Factor mean and SD | | 3.67 | 1.00 |
| **Attitude towards behavior** | | **Mean** | **SD** |
| ATB1 | Accepting gamified e-learning systems is a good idea | 4.28 | 0.841 |
| ATB2 | I am interested in using gamified e-learning systems | 4.11 | 0.879 |
| ATB3 | Accepting gamified e-learning systems have positive effects on the educational process | 4.25 | 0.846 |
| ATB4 | Gamified e-learning systems provide an attractive learning environment People who influence my behaviour think that I should accept gamified e-learning systems | 4.27 | 0.804 |
| Factor mean and SD | | 4.23 | 0.84 |
| **Subjective norm** | | **Mean** | **SD** |
| SN1 | People who influence my behaviour think that I should accept gamified e-learning systems | 3.56 | 0.987 |
| SN2 | Most of those who are around me think that I should accept gamified e- | 3.56 | 0.910 |

| | | | |
|---|---|---|---|
| | learning systems | | |
| SN3 | People who are important to me think that I should not accept gamified e-learning systems | 3.61 | 0.957 |
| SN4 | People whom opinions I value think that I should accept gamified e-learning systems | 3.70 | 0.941 |
| Factor mean and SD | | 3.61 | 0.95 |
| **Image** | | **Mean** | **SD** |
| IMG1 | I think that people who accept gamified e-learning systems are getting better education than those who do not | 3.80 | 1.054 |
| IMG2 | I think that people who accept gamified e-learning systems have good reputation | 3.58 | 0.974 |
| IMG3 | Accepting gamified e-learning systems is good for my reputation | 3.43 | 0.974 |
| IMG4 | Students in my university who accept gamified e-learning systems are known and more respected | 3.22 | 1.041 |
| Factor mean and SD | | 3.51 | 1.01 |
| **Perceived usefulness** | | **Mean** | **SD** |
| PU1 | Gamified e-learning systems allow me to accomplish learning tasks more quickly | 4.07 | 0.802 |
| PU2 | Gamified e-learning systems improve my learning performance | 4.05 | 0.799 |
| PU3 | I find gamified e-learning systems useful in my learning | 4.15 | 0.738 |
| PU4 | Accepting gamified e-learning systems enhances my effectiveness in learning | 4.08 | 0.800 |
| Factor mean and SD | | 4.09 | 0.78 |
| **Perceived ease of use** | | **Mean** | **SD** |
| PEoU1 | Accepting gamified e-learning systems increases my learning productivity | 4.06 | 0.817 |
| PEoU2 | My interaction with gamified e-learning systems is clear and understandable | 3.94 | 0.812 |
| PEoU3 | I find gamified e-learning systems to be easy to use | 3.92 | 0.833 |
| PEoU4 | I find it easy to get a gamified e-learning system to do what I want it to do | 3.82 | 1.021 |
| Factor mean and SD | | 3.93 | 0.87 |
| **Perceived enjoyment** | | **Mean** | **SD** |
| PEnj1 | I find using gamified e-learning systems to be enjoyable | 4.10 | .849 |
| PEnj2 | The actual process of using the gamified e-learning systems is pleasant | 3.57 | 1.057 |
| PEnj3 | I have fun using the gamified e-learning system | 4.09 | .796 |
| Factor mean and SD | | 3.92 | 0.90 |
| **Facilitating conditions** | | **Mean** | **SD** |
| FC1 | Gamified e-learning systems training courses are essential to accept the system | 3.82 | 1.068 |
| FC2 | University infrastructure is important to me to accept gamified e-learning systems | 4.01 | 0.921 |
| FC3 | I accept gamified e-learning systems because IT Staff are available for supporting | 3.94 | 0.893 |
| Factor mean and SD | | 3.92 | 0.96 |
| **Game element** | | **Mean** | **SD** |
| GE1 | The use of game elements into e-learning systems makes the use of e-learning systems more effective? | 4.16 | 0.808 |
| GE2 | The use of game elements into e-learning systems makes the use of e-learning systems more enjoyable? | 4.19 | 0.800 |
| GE3 | The use of game elements into e-learning systems makes me use gamified | 3.92 | 0.942 |

| | | | |
|---|---|---|---|
| | e-learning systems more than using non-gamified e-learning systems? | | |
| Factor mean and SD | | 4.09 | 0.85 |
| **User interface language** | | **Mean** | **SD** |
| UIL1 | I accept gamified e-learning system more because they are presented in Arabic Language | 3.82 | 1.075 |
| UIL2 | I accept gamified e-learning systems more because they are multilingual | 4.00 | 1.001 |
| UIL3 | I accept gamified e-learning systems more because the default language is set to Arabic Language | 3.94 | 0.985 |
| Factor mean and SD | | 3.92 | 1.02 |

The results in Table 6-4 indicate that all factors are in the agreeable zone (mean above 3). Participants were more agreeable to question items for Attitude towards behaviour (mean=4.23, SD=0.84), Perceived usefulness (mean=4.09, SD=0.78), game element (mean=4.09, SD=0.85), while the factor that had a low level of agreement is image with mean score of 3.51 (SD=1.01). Assuming higher agreement scores are indicative of the importance of such factors towards adoption of gamified e-learning systems, the factors with the highest mean scores would be taken to be more important than those with lower means. Nonetheless, caution has to be exercised such that no inferences are made based on descriptive statistics. Rather, descriptive statistics should be viewed as a back-up to inferential statistics.

## 6.2 Factor Analysis

As indicated earlier, this study applies the factor analytical technique to establish the least number of latent constructs (factors) that explain the maximum variance in the dataset. Being a data reduction method, factor analysis mainly relies on the virtue of parsimony such that only a few factors that explain a greater proportion of variance in the data are considered. In other words, using factor analysis, it is anticipated that fewer factors are used to explain greater variance in the outcome variable as opposed to using more variables to explain less variance (Hair *et al.*, 2010). The factor analysis technique groups a number of question items that measure the same latent variable (factor) into the same cluster hence making it easier to measure and interpret constructs that can never be directly observed (latent variables or factors) (Brown, 2015).

### 6.2.1 Exploratory Factor Analysis

In the current study, the conceptual model (GELSAF3) assumed that intention to use gamified e-learning systems is predicted by 12 factors. Each factor is predicted by not less than 3 measurement variables. Nonetheless, after collecting data, the underlying constructs in the dataset may confirm or differ from the conceptual framework that was earlier developed based on literature. To this end, an exploratory factor analysis (EFA) approach is adopted to establish the emerging factor clusters out of the dataset. However, before undertaking (EFA) data has to be assessed for adequacy to support factor analysis. This is done through testing for critical assumptions. Kline (1994) advises that Bartlett's Test of sphericity and the Kaiser Meyer Olkin (KMO) measure of sampling appropriateness should be undertaken before any analysis is performed. Kline (1994) provides that a Bartlett's Test score of <0.05 and a KMO score of >0.5 show adequate correlations within the dataset and sample adequacy, thereby implying that such data with statistics under such a range are suitable for factor analysis.

*Table 6-5 KMO and Bartlett's Test.*

| | | |
|---|---|---|
| **Kaiser-Meyer-Olkin Measure of Sampling Adequacy.** | | .942 |
| **Bartlett's Test of Sphericity** | Approx. Chi-Square | 10986.034 |
| | df | 1128 |
| | Sig. | <0.001 |

The KMO and Bartlett's test signify that the dataset is adequate for the factor analysis. Foremost, the KMO is above 0.5, an indication that there is no significant difference between the model and the current data. On the other hand, the Bartlett's Test of sphericity is significant [$X^2$ (1128) = 10986.034, P<0.001], implying that there are significant relationships between the variables in the dataset to support factor analysis. After obtaining evidence for adequacy of data to undertake factor analysis, the next section entails undertaking EFA to establish the existing number of factors that underlie the dataset.

*Table 6-6 Possible number of factors that underlie the dataset.*

| **Total Variance Explained** | | | | | | |
|---|---|---|---|---|---|---|
| **Component** | **Initial Eigenvalues** | | | **Extraction Sums of Squared Loadings** | | |
| | **Total** | **% of Variance** | **Cumulative %** | **Total** | **% of Variance** | **Cumulative %** |
| 1 | 15.792 | 32.899 | 32.899 | 15.792 | 32.899 | 32.899 |
| 2 | 2.293 | 4.777 | 37.676 | 2.293 | 4.777 | 37.676 |
| 3 | 1.906 | 3.970 | 41.647 | 1.906 | 3.970 | 41.647 |
| 4 | 1.821 | 3.793 | 45.440 | 1.821 | 3.793 | 45.440 |
| 5 | 1.727 | 3.597 | 49.037 | 1.727 | 3.597 | 49.037 |
| 6 | 1.527 | 3.181 | 52.218 | 1.527 | 3.181 | 52.218 |
| 7 | 1.337 | 2.785 | 55.003 | 1.337 | 2.785 | 55.003 |
| 8 | 1.318 | 2.747 | 57.750 | 1.318 | 2.747 | 57.750 |
| 9 | 1.115 | 2.324 | 60.073 | 1.115 | 2.324 | 60.073 |
| 10 | 1.054 | 2.196 | 62.269 | 1.054 | 2.196 | 62.269 |

| Total Variance Explained | | | | | | |
|---|---|---|---|---|---|---|
| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 11 | 0.988 | 2.059 | 64.328 | | | |
| 12 | 0.899 | 1.874 | 66.202 | | | |
| 13 | 0.884 | 1.842 | 68.044 | | | |
| 14 | 0.848 | 1.767 | 69.812 | | | |
| 15 | 0.816 | 1.701 | 71.512 | | | |
| 16 | 0.748 | 1.558 | 73.070 | | | |
| 17 | 0.723 | 1.506 | 74.576 | | | |
| 18 | 0.684 | 1.424 | 76.000 | | | |
| 19 | 0.646 | 1.345 | 77.345 | | | |
| 20 | 0.614 | 1.280 | 78.625 | | | |
| 21 | 0.590 | 1.229 | 79.855 | | | |
| 22 | 0.559 | 1.164 | 81.018 | | | |
| 23 | 0.540 | 1.124 | 82.143 | | | |
| 24 | 0.527 | 1.099 | 83.241 | | | |
| 25 | 0.514 | 1.071 | 84.312 | | | |
| 26 | 0.506 | 1.054 | 85.365 | | | |
| 27 | 0.476 | 0.992 | 86.358 | | | |
| 28 | 0.450 | 0.938 | 87.296 | | | |
| 29 | 0.445 | 0.927 | 88.222 | | | |
| 30 | 0.432 | 0.899 | 89.122 | | | |
| 31 | 0.419 | 0.874 | 89.995 | | | |
| 32 | 0.402 | 0.837 | 90.832 | | | |
| 33 | 0.372 | 0.775 | 91.608 | | | |
| 34 | 0.368 | 0.767 | 92.375 | | | |
| 35 | 0.349 | 0.727 | 93.102 | | | |
| 36 | 0.338 | 0.703 | 93.805 | | | |
| 37 | 0.322 | 0.670 | 94.476 | | | |
| 38 | 0.302 | 0.630 | 95.105 | | | |
| 39 | 0.297 | 0.620 | 95.725 | | | |
| 40 | 0.279 | 0.581 | 96.305 | | | |
| 41 | 0.275 | 0.573 | 96.878 | | | |
| 42 | 0.253 | 0.527 | 97.405 | | | |
| 43 | 0.243 | 0.507 | 97.912 | | | |
| 44 | 0.233 | 0.485 | 98.397 | | | |
| 45 | 0.218 | 0.453 | 98.850 | | | |
| 46 | 0.199 | 0.415 | 99.266 | | | |
| 47 | 0.187 | 0.389 | 99.654 | | | |
| 48 | 0.166 | 0.346 | 100.000 | | | |

Extraction Method: Principal Component Analysis.

From Table 6-6, it is clear that the greatest percentage of variance in the dataset is explained by 10 factors. The 10 factors explain 62% of total variance. This finding contradicts the earlier thought that the dataset is measured by 12 factors including Computer Playfulness; Intention to Use; Computer self-efficacy; Attitude towards behaviour; Subjective norm; Image; Perceived usefulness; Perceived ease of use; Perceived enjoyment; Facilitating conditions; Game element; and User interface language. It is critical to note that a concrete decision on the possible number of factors that underlie the dataset can be reached by comparing the results of Table 6-6 and the scree plot. A scree plot is a visual representation of underlying construct against their Eigen values.

### 6.2.2 Using the scree plot to establish the number of factors that underlie the dataset

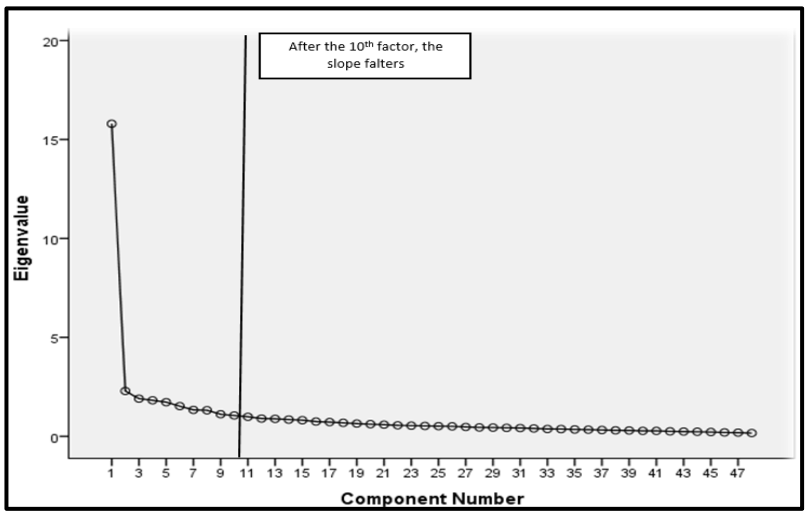


*Figure 6-1 The scree plot.*

The scree plot supports the earlier reported results suggesting the presence of 10 factors that measure the dataset. It is noticed that after component 10, the scree plot becomes flatter and this corresponds to a decline in the eigenvalues after component 10 to less than 1. Using the Kaiser or Mineigen greater than 1 criterion (K1), a decision is taken to only retain factors with eigenvalues greater than 1 (Hayton *et al.*, 2004).

### 6.2.3 Items that measure each of the 10 factors

Whereas evidence suggests the presence of 10 factors that measure the entire dataset, there is need to establish the various measurement items that measure each of the 10 factors. To interpret the factor matrix that contains the variables that measure each of the factors, the matrix is rotated using the varimax method to constrain each variable to load on one factor hence ensuring unidimensionality. A rotated factor matrix table is generated below.

### 6.2.4 Rotated factor matrix

*Table 6-7 Rotated factor matrix.*

| | Label | Component | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| I see myself as spontaneous when I use e-learning systems | CP1 | | | | 0.506 | | | | | | |
| I see myself as flexible when I use e-learning systems | CP2 | | | | 0.606 | | | | | | |
| I see myself as creative when I use e-learning systems | CP3 | | | | 0.536 | | | | | | |
| I see myself as playful when I use e-learning systems | CP4 | | | | 0.717 | | | | | | |
| I see myself as unimaginative when I use e-learning systems | CP5 | | | | 0.465 | | | | | | |
| I see myself as unoriginal when I use e-learning systems | CP6 | | | | | | | | | | 0.656 |
| I see myself as uninventive when I use e-learning systems | CP7 | | | | | | | | | | 0.773 |
| I am using gamified e-learning systems in learning | ITU1 | | | 0.711 | | | | | | | |
| I intend to continue using gamified e-learning systems in learning | ITU2 | | | 0.639 | | | | | | | |
| I frequently use gamified e-learning systems in learning | ITU3 | | | 0.747 | | | | | | | |
| I intend to frequently use gamified e-learning systems in learning | ITU4 | | | 0.720 | | | | | | | |
| I expect my use of gamified e-learning systems to continue in the future | ITU5 | | | 0.354 | | | | | | | |
| I can complete the learning activity using a gamified e-learning system when there was no one around to tell me what to do as I go | CSE1 | | | | | | | | 0.316 | | |
| I can complete the learning | CSE2 | | | | | | | | 0.572 | | |

| | Label | Component | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| activity using a gamified e-learning system because I have used similar e-learning software before that does the same job | | | | | | | | | | | |
| I can complete the learning activity using a gamified e-learning system because I saw someone else using it before trying it myself | CSE3 | | | | | | | | 0.530 | | |
| I can complete the learning activity using a gamified e-learning system because I have the software manuals for reference | CSE4 | | | | | | | | 0.390 | | |
| Accepting gamified e-learning systems is a good idea | ATB1 | 0.734 | | | | | | | | | |
| I am interested in using gamified e-learning systems | ATB2 | 0.575 | | | | | | | | | |
| Accepting gamified e-learning systems have positive effects on the educational process | ATB3 | 0.645 | | | | | | | | | |
| Gamified e-learning systems provide an attractive learning environment | ATB4 | 0.688 | | | | | | | | | |
| People who influence my behaviour think that I should accept gamified e-learning systems | SN1 | | | | | 0.721 | | | | | |
| Most of those who are around me think that I should accept gamified e-learning systems | SN2 | | | | | 0.813 | | | | | |
| People who are important to me think that I should not accept gamified e-learning systems | SN3 | | | | | 0.797 | | | | | |
| People whom opinions I value think that I should accept gamified e-learning systems | SN4 | | | | | 0.708 | | | | | |
| I think that people who accept gamified e-learning | IMG1 | | 0.529 | | | | | | | | |

| | Label | Component | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| systems are getting better education than those who do not | | | | | | | | | | | |
| I think that people who accept gamified e-learning systems have good reputation | IMG2 | | 0.696 | | | | | | | | |
| Accepting gamified e-learning systems is good for my reputation | IMG3 | | 0.752 | | | | | | | | |
| Students in my university who accept gamified e-learning systems are known and more respected | IMG4 | | 0.699 | | | | | | | | |
| Gamified e-learning systems allow me to accomplish learning tasks more quickly | PU1 | 0.534 | | | | | | | | | |
| Gamified e-learning systems improve my learning performance | PU2 | 0.608 | | | | | | | | | |
| I find gamified e-learning systems useful in my learning | PU3 | 0.645 | | | | | | | | | |
| Accepting gamified e-learning systems enhances my effectiveness in learning | PU4 | 0.603 | | | | | | | | | |
| Accepting gamified e-learning systems increases my learning productivity | PEoU1 | 0.634 | | | | | | | | | |
| My interaction with gamified e-learning systems is clear and understandable | PEoU2 | 0.432 | | | | | | | | | |
| I find gamified e-learning systems to be easy to use | PEoU3 | | | | | | | | 0.382 | | |
| I find it easy to get a gamified e-learning system to do what I want it to do | PEoU4 | | | | | | | | 0.426 | | |
| I find using gamified e-learning systems to be enjoyable | PEnj1 | | | | 0.419 | | | | . | | |
| The actual process of using the gamified e-learning | PEnj2 | | | | 0.404 | | | | | | |

| | Label | Component | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| systems is pleasant | | | | | | | | | | | |
| I have fun using the gamified e-learning system | PEnj3 | | | | 0.489 | | | | | | |
| Gamified e-learning systems training courses are essential to accept the system | FC1 | | | | | | | 0.756 | | | |
| University infrastructure is important to me to accept gamified e-learning systems | FC2 | | | | | | | 0.669 | | | |
| I accept gamified e-learning systems because IT Staff are available for supporting | FC3 | | | | | | | 0.645 | | | |
| The use of game elements into e-learning systems makes the use of e-learning systems more effective? | GE1 | | | | | | 0.751 | | | | |
| The use of game elements into e-learning systems makes the use of e-learning systems more enjoyable? | GE2 | | | | | | 0.743 | | | | |
| The use of game elements into e-learning systems makes me use gamified e-learning systems more than using non-gamified e-learning systems? | GE3 | | | | | | 0.440 | | | | |
| The use of game elements into e-learning systems makes the use of e-learning systems more effective? | UIL1 | | | | | | | | | 0.866 | |
| The use of game elements into e-learning systems makes the use of e-learning systems more enjoyable? | UIL2 | | | | | | 0.389 | | | | |
| The use of game elements into e-learning systems makes me use gamified e-learning systems more than using non-gamified e-learning systems? | UIL3 | | | | | | | | | 0.834 | |

From the rotated matrix, the following summary can be derived with regards to the variables measuring each of the different factors.

*Table 6-8 Components and the items that measure them.*

| Co. 1 | Co. 2 | Co. 3 | Co. 4 | Co. 5 | Co. 6 | Co. 7 | Co. 8 | Co. 9 | Co. 10 |
|---|---|---|---|---|---|---|---|---|---|
| ATB1 | IMG1 | ITU1 | CP1 | SN1 | GE1 | FC1 | CSE1 | UIL1 | CP6 |
| ATB2 | IMG2 | ITU2 | CP2 | SN2 | GE2 | FC2 | CSE2 | UIL3 | CP7 |
| ATB3 | IMG3 | ITU3 | CP3 | SN3 | GE3 | FC3 | CSE3 | | |
| ATB4 | IMG4 | ITU4 | CP4 | SN4 | UIL2 | | CSE4 | | |
| PU1 | | ITU5 | CP5 | | | | PEoU3 | | |
| PU2 | | | PEnj1 | | | | PEoU4 | | |
| PU3 | | | PEnj2 | | | | | | |
| PU4 | | | PEnj3 | | | | | | |
| PEoU1 | | | | | | | | | |
| PEoU2 | | | | | | | | | |
| 10 | 4 | 5 | 8 | 4 | 4 | 3 | 6 | 2 | 2 |
| Co. = Component | | | | | | | | | |

Table 6-8 illustrates that whereas some items had been thought to measure different factors, in the dataset, they have been found to be measuring other factors. For instance, component 1 is being measured by items originally from Attitude towards behaviour, Perceived usefulness, and perceived ease of use. This trend is common to component 4, 6, and 8. However, components 2, 3, 5, 7, 9, and 10 are measured by items from one original cluster.

### 6.2.5 Analysis of Components extracted

#### 6.2.5.1 Component 1

Component 1 is measured by 10 items from different classifications of the conceptual model. This is contrary to the earlier conceptualisation where it was anticipated that items under each pre-determined classification would together measure the underlying construct envisaged within the classification. Component 1 is measured by items from the following earlier conceived classifications: 4 items from attitude towards behaviour; 4 items from Perceived Usefulness; and 2 items from Perceived Ease of Use. Whereas the items measuring component 1 originate from three different classifications, a critical review of each of the items suggests that the items relate to perceptions on usefulness of gamified e-learning systems (see Table 6-9). To this end, Component 1 is named Perceived Usefulness (PU).

*Table 6-9 Items measuring Perceived Usefulness Factor and their factor loadings.*

| Item | Label | Factor loadings |
|---|---|---|
| Accepting gamified e-learning systems is a good idea | ATB1 | 0.734 |
| I am interested in using gamified e-learning systems | ATB2 | 0.575 |
| Accepting gamified e-learning systems have positive effects on the educational process | ATB3 | 0.645 |
| Gamified e-learning systems provide an attractive learning environment | ATB4 | 0.688 |
| Gamified e-learning systems allow me to accomplish learning tasks more quickly | PU1 | 0.534 |
| Gamified e-learning systems improve my learning performance | PU2 | 0.608 |
| I find gamified e-learning systems useful in my learning | PU3 | 0.645 |
| Accepting gamified e-learning systems enhances my effectiveness in learning | PU4 | 0.603 |
| Accepting gamified e-learning systems increases my learning productivity | PEoU1 | 0.634 |
| My interaction with gamified e-learning systems is clear and understandable | PEoU2 | 0.432 |

#### 6.2.5.2 Component 2

Four items measure component 2 and all these are from the same classification within the original conceptual framework and they relate to Image. Therefore, component 2 retains the original name - Image

*Table 6-10 Items measuring Image Factor and their factor loadings.*

| Item | Label | Factor loadings |
|---|---|---|
| I think that people who accept gamified e-learning systems are getting better education than those who do not | IMG1 | 0.529 |
| I think that people who accept gamified e-learning systems have good reputation | IMG2 | 0.696 |
| Accepting gamified e-learning systems is good for my reputation | IMG3 | 0.752 |
| Students in my university who accept gamified e-learning systems are known and more respected | IMG4 | 0.699 |

#### 6.2.5.3 Component 3

Component 3 is measured by 5 items and all are from one original classification (Intention to Use) of the conceptual framework. Component 3 retained the original name as is in the conceptual framework - Intention to Use.

*Table 6-11 Items measuring Intention to Use Factor and their factor loadings.*

| Item | Label | Factor loadings |
|---|---|---|
| I am using gamified e-learning systems in learning | ITU1 | 0.711 |
| I intend to continue using gamified e-learning systems in learning | ITU2 | 0.639 |

| Item | Label | Factor loadings |
|---|---|---|
| I frequently use gamified e-learning systems in learning | ITU3 | 0.747 |
| I intend to frequently use gamified e-learning systems in learning | ITU4 | 0.72 |
| I expect my use of gamified e-learning systems to continue in the future | ITU5 | 0.354 |

#### 6.2.5.4 Component 4

Component 4 is measured by 8 items from two original classifications of the conceptual framework. For instance, 5 items are from the original classification of computer playfulness, while 3 items are from perceived enjoyment. Component 4 is therefore measured by a mix of items relating to play and leisure hence the new name - Pleasure.

*Table 6-12 Items measuring Pleasure Factor and their factor loadings.*

| Item | Label | Factor loadings |
|---|---|---|
| I see myself as spontaneous when I use e-learning systems | CP1 | 0.506 |
| I see myself as flexible when I use e-learning systems | CP2 | 0.606 |
| I see myself as creative when I use e-learning systems | CP3 | 0.536 |
| I see myself as playful when I use e-learning systems | CP4 | 0.717 |
| I see myself as unimaginative when I use e-learning systems | CP5 | 0.465 |
| I find using gamified e-learning systems to be enjoyable | PEnj1 | 0.419 |
| The actual process of using the gamified e-learning systems is pleasant | PEnj2 | 0.404 |
| I have fun using the gamified e-learning system | PEnj3 | 0.489 |

#### 6.2.5.5 Component 5

This component is measured by 4 items all from the subject norm classification of the original conceptual framework. Therefore, component 5 is named Subject Norm.

*Table 6-13 Items measuring Subject Norm Factor and their factor loadings.*

| Item | Label | Factor loadings |
|---|---|---|
| People who influence my behaviour think that I should accept gamified e-learning systems | SN1 | 0.721 |
| Most of those who are around me think that I should accept gamified e-learning systems | SN2 | 0.813 |
| People who are important to me think that I should not accept gamified e-learning systems | SN3 | 0.797 |
| People whom opinions I value think that I should accept gamified e-learning systems | SN4 | 0.708 |

#### 6.2.5.6 Component 6

Component 6 is measured by 4 items from two classifications of the original conceptual framework. Three items are from the game element classification while one item is from the user interface language. This component is named Game Elements because all items measuring this underlying construct related to elements of games (see Table 6-14).

*Table 6-14 Items measuring Game Elements Factor and their factor loadings.*

| Item | Label | Factor loadings |
|---|---|---|
| The use of game elements into e-learning systems makes the use of e-learning systems more effective. | GE1 | 0.751 |
| The use of game elements into e-learning systems makes the use of e-learning systems more enjoyable. | GE2 | 0.743 |
| The use of game elements into e-learning systems makes me use gamified e-learning systems more than using non-gamified e-learning systems. | GE3 | 0.44 |
| I think I will accept gamified e-learning systems more if they were multilingual. | UIL2 | 0.389 |

#### 6.2.5.7 Component 7

This component is measured by 3 items all from the original Facilitating Conditions (FC) classification of the conceptual framework. Accordingly, this component is named Facilitating Conditions

*Table 6-15 Items measuring Facilitating Conditions Factor and their factor loadings.*

| Item | Label | Factor loadings |
|---|---|---|
| Gamified e-learning systems training courses are essential to accept the system | FC1 | 0.756 |
| University infrastructure is important to me to accept gamified e-learning systems | FC2 | 0.669 |
| I accept gamified e-learning systems because IT Staff are available for supporting | FC3 | 0.645 |

#### 6.2.5.8 Component 8

This component is measured by 6 items from two original classifications of the conceptual framework. Four items that constitute this scale are from the computer self-efficacy while two items are from the perceived ease of use classification. A critical analysis of the two items from the perceived ease of use classification, makes it clear that they relate more to Computer Self-Efficacy than to perceived ease of use. To this end, component 8 is named Computer Self-Efficacy.

*Table 6-16 Items measuring Computer Self-Efficacy Factor and their factor loadings.*

| Item | Label | Factor loadings |
|---|---|---|
| I can complete the learning activity using a gamified e-learning system when there | CSE1 | 0.316 |

| Item | Label | Factor loadings |
|---|---|---|
| was no one around to tell me what to do as I go | | |
| I can complete the learning activity using a gamified e-learning system because I have used similar e-learning software before that does the same job | CSE2 | 0.572 |
| I can complete the learning activity using a gamified e-learning system because I saw someone else using it before trying it myself | CSE3 | 0.53 |
| I can complete the learning activity using a gamified e-learning system because I have the software manuals for reference | CSE4 | 0.39 |
| I find gamified e-learning systems to be easy to use | PEoU3 | 0.382 |
| I find it easy to get a gamified e-learning system to do what I want it to do | PEoU4 | 0.426 |

#### 6.2.5.9 Components 9 and 10

In as much as the EFA suggested the presence of 10 components, a decision has been taken to ignore and exclude components 9 and 10 from any further analysis. This is based on the fact that they are being measured by only 2 items each which are taken to be very few to measure a latent construct. Moreover, the model with only 2 measurement items would be unidentified.

*Table 6-17 Items measuring Component 9 and Factor and their factor loadings*

| | | |
|---|---|---|
| The use of game elements into e-learning systems makes the use of e-learning systems more effective? | UIL1 | 0.866 |
| The use of game elements into e-learning systems makes me use gamified e-learning systems more than using non-gamified e-learning systems? | UIL3 | 0.834 |

*Table 6-18 Items measuring Component 10 and Factor and their factor loadings*

| | | |
|---|---|---|
| I see myself as unoriginal when I use e-learning systems | CP6 | 0.656 |
| I see myself as uninventive when I use e-learning systems | CP7 | 0.773 |

## 6.3 Modelling the relationships in the dataset using Structural Equation Modelling Technique (SEM)

SEM technical has been chosen to be more appropriate to estimate the relationships in the dataset to answer the questions of the study. This study investigates two kinds of relationships:

i) Relationships between measurement variables and latent variables (factors). The measurement model is used to estimate these relationships

ii) Relationships between latent variables only. These are estimated through the structural model

The measurement and structural models are components of the SEM. It is critical to note that the SEM technique is superior to ordinary least squares (OLS) particularly in instances where variables involved in the investigation are not directly observed (latent factors) (Byrne, 2016). The technique can measure latent variables through observed items (measurement variables). Further, the technique is said to produce more accurate estimates compared to OLS given its ability to estimate an error term associated with each estimate (Benda and Corwyn, 2000). It is imperative to note that OLS techniques tend to aggregate the error terms of estimation into one term which makes it particularly challenging to attribute error terms associated to each point estimated.

### 6.3.1 The Measurement Model

As indicated earlier, the measurement model estimates the relationships between the measurement items and the respective factor measured by the items. However, before the actual estimations can be conducted, it is critical first to ensure that the measurement items reliably and validly measure the respective latent constructs. To this end, Stratford (1989) advises that reliability and validity measures including internal and composite reliabilities, and convergent validity and discriminant validity should be used for purposes of estimating how reliable and valid the measurement items are at measuring the respective underlying construct.

#### 6.3.1.1 Reliability and Validity tests

SEM is based on strict assumptions. Some of such are that the data collected is reliable and valid. Reliability is related to the property of data that necessitates replication of data if the same instrument is used on different samples from the same population. On the other hand, validity measures the property of data that requires that the data collected should measure the intended aspect.

**Reliability tests**

a) **Internal Reliability:** This measures the extent to which measurement items are internally consistent in measuring the latent construct. The typical measure used for this purpose is the Cronbach Alpha. In as much as alphas for all the constructs as listed in the conceptual framework have been earlier on estimated, given that factors have been reconstituted using the EFA, new alphas are computed for the constructs extracted from the dataset using EFA.

*Table 6-19 Internal reliability of items in measuring the respective factors.*

| Factors | Items | Label | Cronbach's Alpha |
|---|---|---|---|
| Perceived Usefulness | Accepting gamified e-learning systems is a good idea | ATB1 | 0.922 |
| | I am interested in using gamified e-learning systems | ATB2 | |
| | Accepting gamified e-learning systems have positive effects on the educational process | ATB3 | |
| | Gamified e-learning systems provide an attractive learning environment | ATB4 | |
| | Gamified e-learning systems allow me to accomplish learning tasks more quickly | PU1 | |
| | Gamified e-learning systems improve my learning performance | PU2 | |
| | I find gamified e-learning systems useful in my learning | PU3 | |
| | Accepting gamified e-learning systems enhances my effectiveness in learning | PU4 | |
| | Accepting gamified e-learning systems increases my learning productivity | PEoU 1 | |
| | My interaction with gamified e-learning systems is clear and understandable | PEoU 2 | |
| | | | |
| Image | I think that people who accept gamified e-learning systems are getting better education than those who do not | IMG1 | 0.73 |
| | I think that people who accept gamified e-learning systems have good reputation | IMG2 | |
| | Accepting gamified e-learning systems is good for my reputation | IMG3 | |
| | Students in my university who accept gamified e-learning systems are known and more respected | IMG4 | |
| | | | |
| Intention to Use | I am using gamified e-learning systems in learning | ITU1 | 0.873 |
| | I intend to continue using gamified e-learning systems in learning | ITU2 | |
| | I frequently use gamified e-learning systems in learning | ITU3 | |
| | I intend to frequently use gamified e-learning systems in learning | ITU4 | |
| | I expect my use of gamified e-learning systems to continue in the future | ITU5 | |
| | | | |
| Pleasure | I see myself as spontaneous when I use e-learning systems | CP1 | 0.81 |
| | I see myself as flexible when I use e-learning systems | CP2 | |
| | I see myself as creative when I use e-learning systems | CP3 | |
| | I see myself as playful when I use e-learning systems | CP4 | |
| | I see myself as unimaginative when I use e-learning systems | CP5 | |
| | I find using gamified e-learning systems to be enjoyable | PEnj1 | |
| | The actual process of using the gamified e-learning systems is | PEnj2 | |

| Factors | Items | Label | Cronbach's Alpha |
|---|---|---|---|
| | pleasant | | |
| | I have fun using the gamified e-learning system | PEnj3 | |
| | | | |
| Subject Norm | People who influence my behaviour think that I should accept gamified e-learning systems | SN1 | 0.856 |
| | Most of those who are around me think that I should accept gamified e-learning systems | SN2 | |
| | People who are important to me think that I should not accept gamified e-learning systems | SN3 | |
| | People whom opinions I value think that I should accept gamified e-learning systems | SN4 | |
| | | | |
| Game Elements | The use of game elements into e-learning systems makes the use of e-learning systems more effective? | GE1 | 0.7 |
| | The use of game elements into e-learning systems makes the use of e-learning systems more enjoyable? | GE2 | |
| | The use of game elements into e-learning systems makes me use gamified e-learning systems more than using non-gamified e-learning systems? | GE3 | |
| | I think I will accept gamified e-learning systems more if they were multilingual. | UIL2 | |
| | | | |
| Facilitating Conditions | Gamified e-learning systems training courses are essential to accept the system | FC1 | 0.72 |
| | University infrastructure is important to me to accept gamified e-learning systems | FC2 | |
| | I accept gamified e-learning systems because IT Staff are available for supporting | FC3 | |
| | | | |
| Computer Self-Efficacy | I can complete the learning activity using a gamified e-learning system when there was no one around to tell me what to do as I go | CSE1 | 0.72 |
| | I can complete the learning activity using a gamified e-learning system because I have used similar e-learning software before that does the same job | CSE2 | |
| | I can complete the learning activity using a gamified e-learning system because I saw someone else using it before trying it myself | CSE3 | |
| | I can complete the learning activity using a gamified e-learning system because I have the software manuals for reference | CSE4 | |
| | I find gamified e-learning systems to be easy to use | PEoU 3 | |
| | I find it easy to get a gamified e-learning system to do what I want it to do | PEoU 4 | |

From Table 6-19, it is clear that all items are internally consistent in measuring their respective factors. This is based on the finding that all factors have their alphas equal or above 0.7.

**b) Composite Reliability (CR)**

Composite Reliability (CR) measures the proportion of total variance that is attributable to the measurement variables. CR is an indicator of the accuracy with which the measurement items measure the respective latent construct. To this end, a higher CR would mean that the measurement items are accurate in measuring the respective latent construct and the reverse would imply that the measurement of the latent construct is full of error. Hair et al. (2010) suggest that a CR of 0.7 indicates reliable measure of the latent construct.

CR is computed as follows:

$$CR = \frac{(\Sigma\lambda)^2}{(\Sigma\lambda)^2 + \Sigma\varepsilon}$$

Where:

- CR is Composite Reliability
- $(\Sigma\lambda)^2$ is the square of total of factor loadings
- $\Sigma\varepsilon$ is the summation of error variance attributable to each factor loading.

Composite Reliability is computed for each latent construct as indicated in Table 6-20 to highlight the extent of accuracy with which the observed variables measure the unobserved variables (factors).

*Table 6-20 Latent constructs and their Composite Reliabilities.*

| Factors | CR |
|---|---|
| Perceived Usefulness | 0.9 |
| Image | 0.84 |
| Intention to Use | 0.85 |
| Pleasure | 0.81 |
| Subject Norm | 0.91 |
| Game Elements | 0.76 |
| Facilitating Conditions | 0.82 |
| Computer Self-Efficacy | 0.67 |

The findings in Table 6-20 indicate that 7 out of 8 latent constructs have composite reliabilities above 0.7 indicating that the measurement variables account for a greater proportion of the variances in the latent variables. In other words, the items chosen, to a greater extent measure the respective latent constructs with minimal errors. Only the CR for Computer Self-Efficacy is slightly below the 0.7 threshold. Nonetheless, the score of 0.67 is close to the threshold and it could be as well taken as acceptable.

**Validity tests**

**a) Convergent Validity (CV)**

Convergent validity (CV) measures the extent to which items converge in measuring the intended underlying construct. The Average Variance Extracted (AVE) is used to measure CV. AVE is computed as the average loading of all the measurement items on a respective factor. Fornell and Larcker (1981) suggested a formula for measuring AVE as below:

$$AVE = \frac{(\Sigma\lambda^2)}{N}$$

Where; $\Sigma\lambda^2$ is the square of total of factor loadings, and N is the total number of measurement items that measure the same construct. According to Turel, Serenko & Bontis (2007), factor loadings range between -1 and +1 and AVE closer to +1 implies greater convergent validity. Within the literature, there is no agreed upon cut-off for acceptable AVE. However, Hair et al. (2010) guides that an AVE estimate of 0.5 could be acceptable CV.

*Table 6-21 Latent constructs and their Average Variance Extracted (AVE).*

| Factors | AVE |
|---|---|
| Perceived Usefulness | 0.61 |
| Image | 0.67 |
| Intention to Use | 0.63 |
| Pleasure | 0.51 |
| Subject Norm | 0.76 |
| Game Elements | 0.58 |
| Facilitating Conditions | 0.69 |
| Computer Self-Efficacy | 0.44 |

Findings from Table 6-21 indicate that 7 out of 8 factors have their AVE above 0.5 implying that they are validly being measured with regard to convergent validity. Only one factor - Computer Self-

Efficacy has AVE below 0.5. This factor is maintained in the subsequent calibrations given that the estimate is not very far from 0.5. Moreover, retention of this factor is due to it being one of the key factors for this study to investigate.

**b) Discriminant validity**

Discriminant validity requires that each item loads to only one factor. In other words, it requires that each item is unidimensional by only measuring one factor. This implies that if an item cross-loads on factors then it does not discriminate between the factors and hence violates the discriminant validity test. To test for discriminant validity, shared variance (squared correlations) between factors are compared against the average of the AVEs for the pair of the constructs being correlated (Farrell and Rudd, 2009). For discriminant validity to be upheld, the squared correlation must be lower than the average AVEs of the pair of constructs being correlated (Farrell and Rudd, 2009). The results indicate that out of the 28 correlated pairs, 26 pairs pass the discriminant validity test. Only two correlated pairs (CSE<-->PU and PLS<-->CSE) violate the discriminant validity given that their squared correlations are greater than the average AVEs of the correlated pair. It can be concluded that the items discriminate well in their loadings apart from the two incidences highlighted above.

*Table 6-22 Test for Discriminant validity.*

| | PU | CSE | PLS | SN | IMG | GE | ITU | FC |
|---|---|---|---|---|---|---|---|---|
| PU | 1 | | | | | | | |
| CSE | 0.60 | 1 | | | | | | |
| PLS | 0.530 | 0.598 | 1 | | | | | |
| SN | 0.321 | 0.296 | 0.305 | 1 | | | | |
| IMG | 0.491 | 0.497 | 0.331 | 0.299 | 1 | | | |
| GE | 0.484 | 0.412 | 0.425 | 0.162 | 0.294 | 1 | | |
| ITU | 0.520 | 0.542 | 0.445 | 0.265 | 0.384 | 0.317 | 1 | |
| FC | 0.356 | 0.348 | 0.361 | 0.287 | 0.230 | 0.364 | 0.261 | 1 |

PU is Perceived Usefulness, CSE is Computer Self-Efficacy, PLS is Pleasure, SN is Subject Norm, IMG is Image, GE is Game Element, ITU is Intention To Use, FC is Facilitating Conditions

#### 6.3.1.2 Estimation of the Measurement Models

Given that there are 8 factors, each is measured by various measurement items. This implies that the study consists of 8 measurement models to be estimated in order to establish the extent to which the measurement items predict the respective latent construct. This is a critical step before estimating the structural model. In estimating measurement models, maximum attention is paid to the key assumption that the model fits the data. This assumption is tested using benchmark fit indices that test the goodness of fit (GoF) of the model.

### Goodness of Fit indices

Goodness of fit indices (GoF) test the extent to which a model fits the observed data. GoF is achieved if there is not significant difference between the hypothetical ideal model and the estimated model using the observed data. There are numerous GoF indices, each serving different purposes. Nonetheless, Hair et al. (2010) indicates that these can be classified into basic GoF indices; the absolute GoF indices, the incremental GoF indices and the parsimonious GoF indices. It is advised to test GoF of a model across a selection of indices using at least one from each of the broader categorisations (Byrne, 2016).

The Chi-square ($\chi^2$) is the most commonly used basic GoF index to measure the extent to which the currently estimated model is similar to the hypothetic/ideal model. A good fit requires the Chi-square to be insignificant ($p > 0.05$) such that there would be no significant difference between the estimated model and the ideal/hypothetical perfect model. However, Kline (2011) warns that the Chi-square is highly sensitive to large samples and it is more likely to be significant even where the model fits the data. To this end, Kline (2011) advises that this statistic should not be relied upon to conclude GoF of a model. It should be used concurrently with other categories of GoF as earlier indicated.

Within the absolute GoF indices, the Goodness of Fit Index (GFI) and the Root Mean Square Error of Approximation (RMSEA) are commonly used to test GoF of models. GFI estimates the extent of convergence of the measurement variables in measuring the construct. To this end, a good fit only exists where the GFI is higher, that is, equal or above 0.9. RMSEA is a very popular absolute index which measures the extent of deviation between the observed and expected covariance among variables. To this end, lower deviations from the norm are required to ensure goodness of fit. Therefore, RMSEA needs to be as low as 0.07 (see Kline, 2011; Hair *et al.*, 2010; Byrne, 2016).

From the incremental or comparative fit indices, the Normed Fit Index (NFI) and Comparative Fit Indices (CFI) are popularly used in assessing GoF. The two indices measure the relative improvement in the estimated model relative to the one without the measurement variables contained in the estimated model. To this end, greater improvements are preferred in the range of 0.9 and above. Below is a summary of the key GoF indices and the acceptable estimates as suggested by various authors including (Kline, 2011; Hair *et al.*, 2010; Byrne, 2016).

*Table 6-23 GoF indices and the benchmark cut-offs for acceptable GoF.*

| | $X^2$(df) | GFI | CFI | TLI | RMSEA |
|---|---|---|---|---|---|
| Benchmark | p > 0.05 | ≥ 0.9 | ≥ 0.90 | ≥ 0.90 | ≤ 0.07 |

The next subsections entail assessing each of the 8 measurement models against the GoF indices.

**Perceived usefulness measurement model**

Perceived usefulness (PU) is measured by 10 items. First calibration of the model shows that the model does not fit the data as highlighted below:

*Table 6-24 Fit indices of the initial perceived usefulness measurement model against the benchmark.*

| | $X^2$(df) | GFI | CFI | TLI | RMSEA |
|---|---|---|---|---|---|
| Benchmark | p > 0.05 | ≥ 0.9 | ≥ 0.90 | ≥ 0.90 | ≤ 0.07 |
| Estimated model | p < 0.05 | 0.87 | 0.9 | 0.89 | 0.122 |

From Table 6-24, it is clear that RMSEA is outside the acceptable range while CFI is acceptable. The Chi-square is significant, but this should not be the focus of the test given that this statistic is highly sensitive to bigger numbers of participants. A critical analysis of the modification indices suggested that improvements would be attained if particular modifications are partaken. Modification indices help to identify particular modifications that would leverage improvement of the model fit. However, it is critical to note that each suggested modification should be based on logic and empiricism, before it is undertaken. Therefore, not every suggested modification should be pursued because it may not be justifiable, albeit being able to improve the model fit. From the modification indices, it is suggested that if the analysis is repeated treating the covariance between 'e1 (associated to ATB1) and e2 (associated to ATB2)'; and 'e3 (associated to ATB3) and e4 (associated to ATB4)' as free parameters, the model would improve due to reduced discrepancies. A critical analysis of the items associated to e1 and e2 revealed that the two items are phrased in a way that they look similar. The same applies to items ATB3 and ATB4. Therefore, there is empirical reason to correlate e1 and e2, and e3 and e4. These modifications led to significant improvements in GoF as indicated below:

*Table 6-25 Fit indices of the final modified measurement model for perceived usefulness.*

| | $X^2$(df) | GFI | CFI | TLI | RMSEA |
|---|---|---|---|---|---|
| Benchmark | p > 0.05 | ≥ 0.9 | ≥ 0.90 | ≥ 0.90 | ≤ 0.07 |
| Estimated model | p < 0.05 | 0.944 | 0.962 | 0.95 | 0.64 |

From Table 6-25, it is clear that the modified perceived usefulness model fits the data and this model is preferred to the initial one. Below are the detailed model results.

*Table 6-26 Perceived usefulness measurement model estimate results.*

| Paths | β (standardised) | P(sig) |
|---|---|---|
| ATB1 →Perceived Usefulness | 0.634 | 0.001 |
| ATB2 → Perceived Usefulness | 0.676 | 0.001 |
| ATB3 → Perceived Usefulness | 0.61 | < 0.001 |
| ATB4 → Perceived Usefulness | 0.674 | 0.001 |
| PU1 → Perceived Usefulness | 0.742 | 0.001 |
| PU2 → Perceived Usefulness | 0.789 | < 0.001 |
| PU3→ Perceived Usefulness | 0.817 | 0.001 |
| PU4 → Perceived Usefulness | 0.827 | 0.001 |
| PEoU1 → Perceived Usefulness | 0.796 | 0.001 |
| PEoU2 → Perceived Usefulness | 0.706 | < 0.001 |

Table 6-26 shows that all the 10 measurement items significantly measure perceived usefulness (all p<.01)

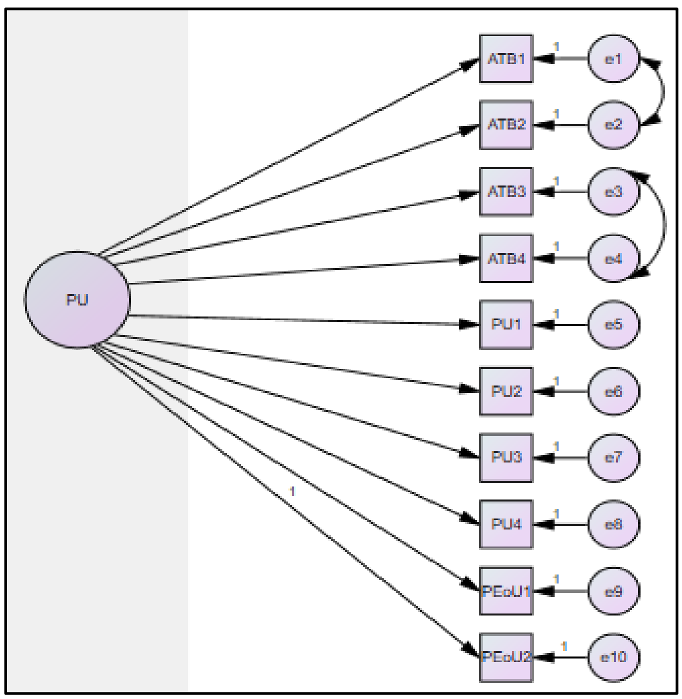


*Figure 6-2 Visual representation of the PU measurement model.*

**Image measurement model**

Four measurement items constitute the image factor. These include IMG1, IMG2, IMG3, and IMG4. On first calibration, the model fits the data and does not require any modification. Only the chi-square value does not fit. Nonetheless, as earlier on indicated, the chi-square value is rarely insignificant given that it is highly sensitive to sample size. To this end, the chi-square benchmark will be ignored.

*Table 6-27 Fit indices for Image factor.*

| | $X^2$(df) | GFI | CFI | TLI | RMSEA |
|---|---|---|---|---|---|
| Benchmark | p>.05 | ≥ 0.9 | ≥ 0.90 | ≥ 0.90 | ≤0.07 |
| Estimated model | P<.05 | 0.984 | 0.980 | 0.940 | 0.026 |

The model estimates indicate that each of the four items significantly measure the image factor (all p<0.01

*Table 6-28 Model estimate results (Image factor).*

| Paths | β (standardised) | P(sig) |
|---|---|---|
| IMG1 →IMAGE | 0.649 | 0.001 |
| IMG 2 → IMAGE | 0.85 | 0.000 |
| IMG3 → IMAGE | 0.82 | 0.000 |
| IMG4 → IMAGE | 0.618 | 0.001 |

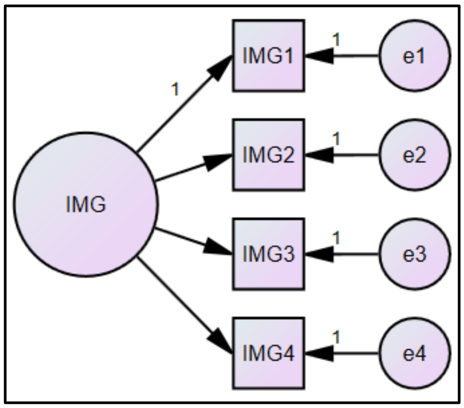


*Figure 6-3 Visual representation of the image measurement model.*

**Intention to use (ITU) measurement model**

The ITU factor is measured by 5 items including ITU1, ITU2, ITU3, ITU4, and ITU5. Apart from the chi-square value, the rest of the indices indicate that the model fits the data on first calibration and no modifications are required.

*Table 6-29 GoF indices for Intention to use (ITU) measurement model.*

| | $X^2$(df) | GFI | CFI | TLI | RMSEA |
|---|---|---|---|---|---|
| Benchmark | p>.05 | ≥ 0.9 | ≥ 0.90 | ≥ 0.90 | ≤0.07 |
| Estimated model | P<.05 | 0.979 | 0.984 | 0.967 | 0.021 |

*Table 6-30 Model estimate results (Image factor).*

| Paths | β (standardised) | P(sig) |
|---|---|---|
| ITU1 →INTENTION-TO-USE | 0.723 | 0.000 |
| ITU 2 → INTENTION-TO-USE | 0.767 | 0.000 |
| ITU 3 → INTENTION-TO-USE | 0.861 | 0.000 |
| ITU 4 → INTENTION-TO-USE | 0.862 | 0.000 |
| ITU 5 → INTENTION-TO-USE | 0.583 | 0.000 |

From Table 6-30, all the five items that measure ITU are significant at p<.01.

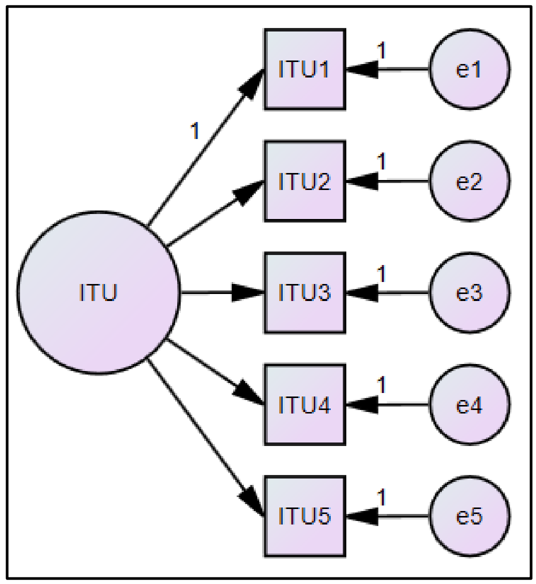


*Figure 6-4 Visual representation of the ITU measurement model.*

**Pleasure measurement model**

This is measured by 8 items CP1-5, and PEnj1-3. On first calibration, most of the GoF indices are acceptable excluding RMSEA which is reported at 0.089 hence above the threshold of 0.07.

*Table 6-31 Initial GoF indices for the Pleasure measurement model.*

| | $X^2(20)$ | GFI | CFI | TLI | RMSEA |
|---|---|---|---|---|---|
| Benchmark | p>.05 | ≥ 0.9 | ≥ 0.90 | ≥ 0.90 | ≤0.07 |
| Estimated model | P<.05 | 0.950 | 0.929 | 0.900 | 0.089 |

From Table 6-31, it is clear that the initial Pleasure measurement model does not fit the data. A critical analysis of the modification indices suggested an improvement in the model if the analysis was repeated after treating the covariance between e6 and e8 as a free parameter. The suggested modification was checked to establish whether correlating the two errors would be justified. The two errors 'e6 and e8' are associated with PEnj1 and PEnj3 measurement items respectively. These two items apprear as follows in the questionnaire:

PEnj1: I find using gamified e-learning systems to be enjoyable.

PEnj3: I have fun using the gamified e-learning system.

The two items are very close in meaning and can easily be interpreted by the respondent to be the same and hence this is justification to correlate the two errors associated to these two items.

When 'e6 and e8' were allowed to correlate, there was significant improvement in the model fit as shown in Table 6-32.

*Table 6-32 GoF indices for the final modified Pleasure measurement model.*

| | $X^2(19)$ | GFI | CFI | TLI | RMSEA |
|---|---|---|---|---|---|
| Benchmark | p > 0.05 | ≥ 0.9 | ≥ 0.90 | ≥ 0.90 | ≤ 0.07 |
| Estimated model | p < 0.05 | 0.977 | 0.975 | 0.964 | 0.053 |

*Table 6-33 Model estimate results (PLEASURE Factor).*

| Paths | β (standardised) | P(sig) |
|---|---|---|
| CP1 →PLEASURE | 0.523 | 0.001 |
| CP2 → PLEASURE | 0.693 | 0.000 |
| CP3 → PLEASURE | 0.611 | 0.001 |
| CP4 → PLEASURE | 0.759 | 0.000 |
| CP5 → PLEASURE | 0.541 | 0.000 |
| PEnj1→ PLEASURE | 0.58 | 0.000 |
| PEnj2 → PLEASURE | 0.376 | 0.000 |
| PEnj3 → PLEASURE | 0.66 | 0.000 |

From Table 6-33, all the 8 measurement variables significantly measure PLEASURE (all $p<.01$).

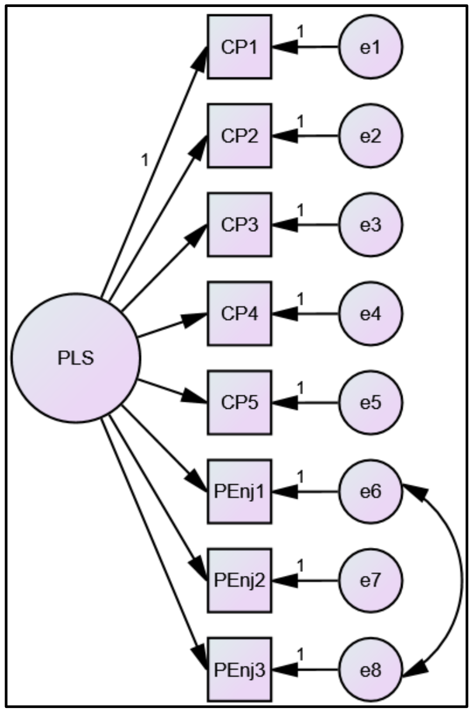


*Figure 6-5 Visual representation of the final PLEASURE measurement model.*

**Subject Norm measurement model**

Subject norm factor is measured by 5 items, SN1-4. On first calibration, the model perfectly fits the data on all the GoF indices including the chi-square statistic.

*Table 6-34 GoF indices for the Subject-Norm measurement model.*

| | $X^2(2)$ | GFI | CFI | TLI | RMSEA |
|---|---|---|---|---|---|
| Benchmark | p>.05 | ≥ 0.9 | ≥ 0.90 | ≥ 0.90 | ≤0.07 |
| Estimated model | P>.05 | 0.998 | 1 | 1 | 0.001 |

*Table 6-35 Model estimate results (Subject-Norm Factor).*

| Paths | β (standardised) | P(sig) |
|---|---|---|
| SN1 →SUBJECT-NORM | 0.712 | 0.000 |
| SN2 → SUBJECT-NORM | 0.825 | 0.000 |
| SN3 → SUBJECT-NORM | 0.8 | 0.000 |
| SN4 → SUBJECT-NORM | 0.763 | 0.000 |

From Table 6-35, all the four items are significant in measuring Subject-Norm factor (all p<0.01)

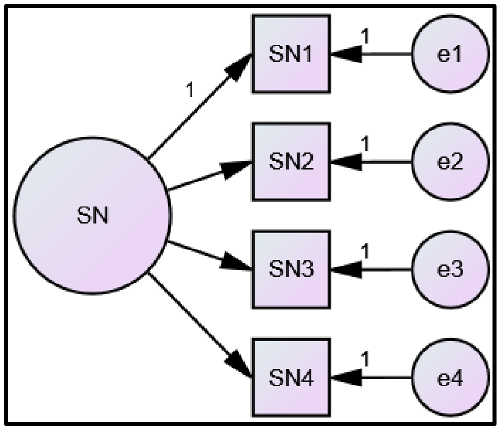


*Figure 6-6 Visual representation of the final Subject-Norm measurement model.*

**Game Element measurement model**

Game Element (GE) factor is measured by 4 items, GE1-3 and UIL2. On first calibration, the model fits the data on all GoF indices including the chi-square statistic.

*Table 6-36 GoF indices for the Game Element measurement model.*

| | $X^2(2)$ | GFI | CFI | TLI | RMSEA |
|---|---|---|---|---|---|
| Benchmark | p>.05 | ≥ 0.9 | ≥ 0.90 | ≥ 0.90 | ≤0.07 |
| Estimated model | P>.05 | 0.996 | 0.996 | 0.988 | 0.044 |

*Table 6-37 Model estimate results (Game Element Factor).*

| Paths | β (standardised) | P(sig) |
|---|---|---|
| GE1 →GAME ELEMENT | 0.819 | 0.000 |
| GE2 → GAME ELEMENT | 0.848 | 0.000 |
| GE3 → GAME ELEMENT | 0.472 | 0.000 |
| UIL2 → GAME ELEMENT | 0.348 | 0.000 |

From Table 6-37 all the four items are significant in measuring the Game Element factor (all p < 0.01).

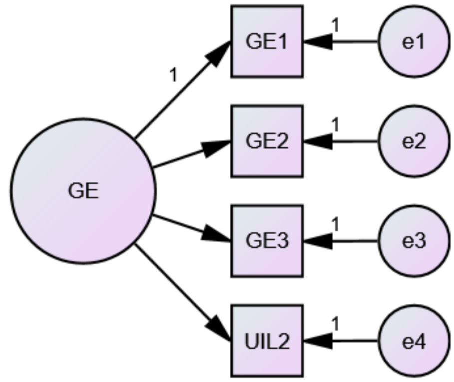


*Figure 6-7 Visual representation of the final Game Element measurement model.*

**Computer Self Efficacy (CSE) measurement model**

This factor is measured by 6 items including CSE1-4 and PEoU3-4. On first estimation, the model does not fit the data.

*Table 6-38 Initial GoF indices for the Computer-Self-Efficacy measurement model.*

| | $X^2(9)$ | GFI | CFI | TLI | RMSEA |
|---|---|---|---|---|---|
| Benchmark | p>.05 | ≥ 0.9 | ≥ 0.90 | ≥ 0.90 | ≤0.07 |
| Estimated model | P<.05 | 0.947 | 0.865 | 0.775 | 0.127 |

The modification indices suggest that if the analysis is repeated after treating the covariance between 'e5 and e6' as a free parameter, the model fit would improve. Before correlating the two errors, further examination was undertaken to establish whether such modification would be justified. Errors 'e5 and e6' belong to two measurement items, that is, PEoU3 and PEoU4 respectively. These two items appear as follows in the questionnaire:

PEoU3: I find gamified e-learning systems to be easy to use.

PEoU4: I find it easy to get a gamified e-learning system to do what I want it to do.

The two items are closely related in meaning and it can be concluded that the error committed in answering one of them can easilyt be committed in answering the other. Hence, correlating the two errors is justified. When the two errors are correlated, the model significantly improves.

*Table 6-39 GoF indices for the final modified Computer-Self-Efficacy measurement model.*

| | $X^2(8)$ | GFI | CFI | TLI | RMSEA |
|---|---|---|---|---|---|
| Benchmark | p > 0.05 | ≥ 0.9 | ≥ 0.90 | ≥ 0.90 | ≤ 0.07 |
| Estimated model | p < 0.05 | 0.985 | 0.975 | 0.953 | 0.058 |

*Table 6-40 Model estimate results (CSE Factor).*

| Paths | β (standardised) | P(sig) |
|---|---|---|
| CSE1 →COMPUTER SELF EFFICACY | 0.526 | 0.000 |
| CSE2 → COMPUTER SELF EFFICACY | 0.772 | 0.000 |
| CSE3 → COMPUTER SELF EFFICACY | 0.607 | 0.000 |
| CSE4 → COMPUTER SELF EFFICACY | 0.448 | 0.000 |
| PEoU3 → COMPUTER SELF EFFICACY | 0.413 | 0.000 |
| PEoU3→ COMPUTER SELF EFFICACY | 0.432 | 0.000 |

From Table 6-40, all the 6 measurement variables significantly measure Computer Self Efficacy factor (all $p < 0.01$).

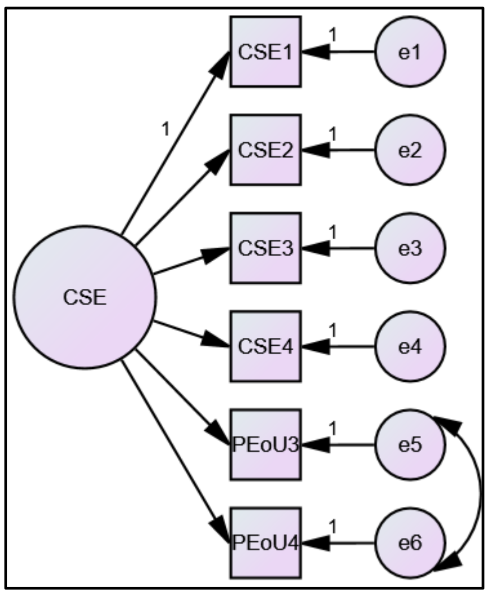


*Figure 6-8 Visual representation of the final CSE measurement model*

**Facilitating Conditions (FC) measurement model**

The FC factor is measured by 3 items, FC1-3. The model has zero degrees of freedom (*df*) and so cannot be effectively estimated to assess model fit due to insufficient *df*. In other words, there is no freedom within the data to vary the estimations. This has been caused by the fact that the factor is being measured by 3 items meaning that the number of distinct sample moments (i.e., variances and covariance) is 6 and the number of distinct parameters to be estimated (i.e., error variances and factor loadings) is 6, hence leaving zero degrees of freedom. In this case there are 6 elements in the covariance matrix and 6 parameters to be estimated, hence zero degrees of freedom. This factor is dropped from further estimation.

### 6.3.2 Structural model Analysis

The above measurement model analysis indicates that the factors are reliably measured by their respective measurement items, save for the “Facilitating Conditions Model”. In this section, the Structural Model is estimated for the relationships between the latent variables. From the conceptual model, hypothetical relationships were alluded to on the basis of the conclusions drawn from the literature review. These hypotheses are to be tested in the Structural Model analysis.

#### 6.3.2.1 Hypotheses to be tested

1. Perceived usefulness (PU) of a gamified e-learning system is positively associated with the students’ Intention To Use (ITU) the gamified e-learning system.

2. Image (IMG) is positively associated with the students’ Intention To Use (ITU) the gamified e-learning system.

3. Pleasure (PLS) derived from using a gamified e-learning system is positively associated with the students’ Intention To Use (ITU) the gamified e-learning system.

4. Subjective Norm (SN) is positively associated with the students’ Intention To Use (ITU) a gamified e-learning system.

5. The use of Game Elements is positively associated with the students’ Intention To Use (ITU) a gamified e-learning system.

6. Computer Self-Efficacy (CSE) is positively associated with the students’ Intention To Use (ITU) a gamified e-learning system.

The above hypotheses to be tested can be summarised in the table as below:

*Table 6-41 Hypothesised paths to be estimated in the structural model.*

| Construct | Hypothesis | Relationships |
|---|---|---|
| Perceived Usefulness (PU) | H1 (+) | PU → ITU |
| Image (IMG) | H2 (+) | IMG → ITU |
| Pleasure (PLS) | H3 (+) | PLS → ITU |
| Subject Norm (SN) | H4 (+) | SN → ITU |
| Game Elements (GE) | H5 (+) | GE → ITU |
| Computer Self-Efficacy (CSE) | H6 (+) | CSE → ITU |

#### 6.3.2.2 Construction of the Structural Model

As suggested earlier, a Structural Model estimates relationship between latent constructs. In this study, the Intention to Use gamified e-learning system (ITU) is the predicted construct. On the other hand, Perceived Usefulness (PU), Image (IMG), Pleasure (PLS), Subject Norm (SN), Game Elements (GE), and Computer Self-Efficacy (CSE) are the factors thought to predict ITU.

It therefore means that a combination of measurement models gives rise to a Structural Model. Given that the measurement models have already been constructed and assessed for GoF, they will be used to construct the structural model to enable the estimation of the various Structural Equations that underlie the Structural Model.

The first estimation of the initial structural model shows that the model does not fit the data (see Table 6-42).

*Table 6-42 Initial GoF indices for the Structural Model.*

| | X2(9) | GFI | CFI | TLI | RMSEA |
|---|---|---|---|---|---|
| Benchmark | $p > 0.05$ | ≥ 0.9 | ≥ 0.90 | ≥ 0.90 | ≤ 0.07 |
| Estimated model | $p < 0.05$ | 0.721 | 0.776 | 0.761 | 0.078 |

#### 6.3.2.3 Modifications

On top of the earlier modifications effected during the estimation of the measurement models, the modification indices for the Structural Model suggest that greater model improvement would be achieved if the analysis was repeated after treating the covariances between i) Perceived Usefulness (PU) and Pleasure (PLS) ii) Subject Norm (SN) and Image (IMG), and iii) Computer Self-Efficacy (CSE) and Image (IMG); as free parameters. The suggested relationships were investigated to establish if they are justified. Many studies (see Lu *et al.*, 2009; Schepers and Wetzels, 2007; Park, 2009; Hsu and Lu, 2004; Legris *et al.*, 2003) confirm existence of significant relationships between Perceived Usefulness (PU) and Pleasure (PLS), Subject Norm (SN) and Image (IMG), and Computer Self-Efficacy (CSE) and Image (IMG). On this basis, these relationships were allowed to correlate. This significantly improved the model fit and eventually led to the model fitting the data.

*Table 6-43 GoF indices for the final modified Structural Model.*

| | X2(8) | GFI | CFI | TLI | RMSEA |
|---|---|---|---|---|---|
| Benchmark | $p > 0.05$ | ≥ 0.9 | ≥ 0.90 | ≥ 0.90 | ≤ 0.07 |
| Estimated model | $p < 0.05$ | 0.973 | 0.952 | 0.923 | 0.069 |

#### 6.3.2.4 Results of the Structural Model

*Table 6-44 Standardised Regression coefficients.*

| Hypothesized Paths | β (standardised) | Critical Ratio | P(sig) |
|---|---|---|---|
| GE → ITU | 0.098 | 2.041 | 0.041 |
| PU → ITU | 0.247 | 2.669 | 0.008 |
| CSE → ITU | 0.368 | 4.832 | 0.001 |
| SN → ITU | 0.124 | 2.285 | 0.022 |
| PLS → ITU | 0.253 | 2.595 | 0.009 |
| IMG → ITU | 0.105 | 1.495 | 0.135 |

From the results' Table 6-44, five out of the six paths are statistically significant. Only one is not significant. This implies that five factors out of six are significant for predicting Intention To Use gamified e-learning system (ITU). Specifically, Game Element (GE), Perceived Use (PU), Computer Self-Efficacy (CSE), Subject Norm (SN), and Pleasure (PLS) significantly influence the students' Intention To Use gamified e-learning system in a positive way. On the other hand, whereas Image (IMG) is positively associated with ITU, it does not significantly influence ITU.

#### 6.3.2.5 The findings and the Hypotheses

In this subsection, effort is directed towards relating the findings to the earlier set hypotheses as derived from the conceptual model in order in order to establish the extent to which the findings support or reject the hypothesis.

**Hypothesis 1**: Perceived usefulness (PU) of gamified e-learning system is positively associated with the students' Intention To Use (ITU) the gamified e-learning system.

From the findings, PU positively influences ITU. The standardised path coefficient (β) for PU is 0.247 with a critical ratio of 2.669. This means that, other factors constant, when PU increases by a standard deviation, ITU increases by 0.247 of a standard deviation. This result is significant at 5% significance level ($p < 0.05$). The finding supports the hypothesis of a positive association between the two factors. The size of the β coefficient of PU makes it the third most important factor in influencing the intention to use gamified e-learning system, out of the six factors.

**Hypothesis 2**: Image (IMG) is positively associated with the students' Intention To Use (ITU) the gamified e-learning system.

The findings show that image is positively associated with ITU, however, it does not significantly influence one's Intention To Use Gamified e-learning system ($\beta = 0.105$, CR = 1.495, $p > 0.05$). This finding contradicts hypothesis 2 which envisaged a significant and positive relationship between IMG and ITU. Therefore, this finding does not support the hypothesis.

**Hypothesis 3**: Pleasure (PLS) derived from using gamified e-learning system is positively associated with the students' Intention To Use (ITU) the gamified e-learning system.

Pleasure derived from using gamified e-learning system was found to be positively associated with the students' intention to use gamified e-learning system. The standardised coefficient ($\beta$) of this path is 0.253. This means that a standard deviation increase in the Pleasure derived from gamified e-learning system leads to a 0.253 standard deviation increase in the Intention to Use gamified e-learning system. This result is significant at 5% significance level ($p < 0.05$). This result supports the earlier stated hypothesis. The magnitude of the $\beta$ coefficient for Pleasure makes it the second most important factor in influencing the students' intention to use gamified e-learning system, out of the six factors.

**Hypothesis 4**: Subject Norm (SN) is positively associated with the students' Intention to Use (ITU) the gamified e-learning system.

The analysis shows that the subject norms of students have a positive impact on an individual student's decision to adopt gamified e-learning system. The path coefficient ($\beta$) of 0.124 implies that a standard deviation increase in the measure of subject norm would lead to a 0.124 standard deviation increase in one's intention to use gamified e-learning system. This result is statistically significant at $p < 0.05$. This result supports the earlier hypothesis suggesting that when the subject norms of the peers are positive, the individual students are more likely to decide to adopt gamified e-learning system.

**Hypothesis 5**: The use of Game Elements is positively associated with the students' Intention to Use (ITU) the gamified e-learning system.

The use of Game Elements was found to positively influence the students' intention to use gamified e-learning systems. The standardised coefficient ($\beta$) of 0.098 means that an increase in the use of Game Elements by a standard deviation leads to an increase in the students' intention to use gamified e-learning system by 0.098 standard deviations. This result is statistically significant at 5% significance level ($p < 0.05$). This finding supports the earlier stated hypothesis.

**Hypothesis 6**: Computer Self-Efficacy (CSE) is positively associated with the students' Intention to Use (ITU) the gamified e-learning system.

Computer Self-Efficacy (CSE) was found to positively influence one's intention to use gamified e-learning systems. The standardised coefficient of (β) 0.368 means that a standard deviation increase in one's computer self-efficacy leads to an increase in one's intention to use gamified e-learning system by 0.368 standard deviations. This result supports the earlier stated hypothesis and it is statistically significant. Since CSE has the biggest standardised coefficient (β) compared to other factors, it means that CSE is the most influential factor in predicting intention to use gamified e-learning system.

# Chapter 7: Discussion of the Findings

This chapter entails a discussion of the findings of the study in relation to the empirical literature and theory. Before the discussion, a summary of findings of the study is given. The research undertook to study the factors that influence students' Intention to Use (ITU) gamified e-learning systems in Saudi universities. This arose on the backdrop of rampant resentment of e-learning systems by students in Saudi Universities. Analysis of the factors was based on a conceptual model (GELSAF3) constructed out of the literature review, albeit with some modifications informed by estimations of the structural equation models. Specifically, the analysis provided answers to the following research questions:

**Main research question:**

*What is the appropriate framework with which to determine the acceptance of gamified e learning systems by students in universities in Saudi Arabia?'*

**Sub-research questions:**

*Q1: According to literature, what are the factors that constitute the GELSAF?*

*Q2: What are the factors that influence students' intention to accept gamified e-learning systems?*

It is imperative to note that Q1 was answered through the critical literature review of literature related to technology acceptance models and theories. Therefore, this discussion concerns the findings about the factors that affect students' attention to accept gamified e-learning systems.

The study took the following hypotheses with regards to the factors that explain students' ITU:

H1. Perceived usefulness (PU) of gamified e-learning system is positively associated with the students' Intention To Use (ITU) the gamified e-learning system.

H2. Image (IMG) is positively associated with the students' Intention To Use (ITU) the gamified e-learning system.

H3. Pleasure (PLS) derived from using gamified e-learning system is positively associated with the students' Intention To Use (ITU) the gamified e-learning system.

H4. Subject Norm (SN) is positively associated with the students' Intention To Use (ITU) the gamified e-learning system.

H5. The use of Game Elements is positively associated with the students' Intention To Use (ITU) the gamified e-learning system.

H6. Computer Self-Efficacy (CSE) is positively associated with the students' Intention To Use (ITU) the gamified e-learning system.

Given that all the variables in the study are latent variables, Structural Equation Modelling (SEM) was used to test the above hypotheses. All the hypotheses were accepted save for hypothesis 2, where no statistical evidence was available to support it. Below, each finding is discussion in detail.

## 7.1 Perceived Usefulness (PU) and the Students' Intention To Use (ITU) Gamified E-Learning Systems

The findings indicate that PU of gamified e-learning system positively influences students' intention to use (ITU) gamified e-learning system in Saudi Universities. Based on the sizes of critical ratios (CR), this factor is the second most important determinant ITU. This finding means that if students believe that gamified e-learning systems are useful in terms of enhancing their abilities to perform their study tasks, they will be more willing to adopt the system than otherwise. This result was expected based on the hypothesis that PU is positively associated with ITU. Also, the result is aligned to many of the reviewed empirical studies (Chokri, 2012; Al-Adwan *et al.*, 2013). Further, (Masa'deh *et al.*, 2016; Attuquayefio and Addo, 2014; Ngampornchai and Adams, 2016) argue that technology users have performance expectations which they use to benchmark the usefulness of any system to be introduced. Accordingly, users are more likely to adopt technologies that meet their expectations.

This finding has significant implications for universities in Saudi Arabia. Foremost, the result demands universities to assess their students' needs with regards to e-learning and to identify the key features that such an e-learning system should have if it is to be accepted. This information can be used to inform the design of the e-learning system to be introduced into universities. By doing so, the chances of students adopting the system will be higher than otherwise. Such a process would also call for the adoption of open policies by the Saudi Universities where students' have more space to communicate their needs to management.

## 7.2 Image (IMG) and Intention To Use Gamified E-Learning Systems

Whereas the Image factor (IMG) was found to be positively related to ITU, its influence was found to be statistically insignificant. This result was not expected given that it had been hypothesized that the degree to which use of a technology is perceived to enhance a student's image or status amongst their peers makes it more likely for the student to adopt it. This hypothesis had been shaped by earlier studies that argued similarly. For instance, this finding contradicts the findings by (Mitzner *et al.*, 2010) study of reasons that made older persons resist the use of assistive technologies that created stereotypes and misconceptions about them. In such a case image was a significant factor.

There could be two reasons for the non-significance of image as a factor that influences ITU. Foremost, it could be true that students in Saudi Arabia do not care about their image being or not being enhanced by adoption of new technologies. This might be the case in such instances where males do not mix with females in schools and therefore image before the others may not carry much weight as the case would be in instances where both sexes mix. In the latter instance, young people tend to want to preserve their images and they would resist anything that is likely to harm it. Secondly, it is likely that the relationship between image and ITU is not linear and or is indirect. For instance, some studies (see Karahanna *et al.*, 1999) have found image to be a post-adoption factor for technology. In other words, image may affect technology usage after adoption and not before adoption.

It is critical to note that many studies have found image to be an important factor for adopting new systems (see Rogers (2010). This therefore implies that the findings of this study should not in any way be taken to downplay the importance of image. Rather, this result partly shows how unstable the effects of image can be on intention to use new technologies. Moreover, this result should be used as impetus for further studies about this factor particularly in the Arabia universities to establish whether the factor has an indirect effect on ITU.

## 7.3 Pleasure (PLS) and Intention to Use Gamified E-learning Systems

Pleasure derived from using e-learning systems was found to positively influence students' intention to use gamified e-learning systems. The result is statistically significant and was expected. Given that this factor is measured by a mix of items relating to play and leisure means that students are more likely to adopt gamified e-learning systems if they involve playful and leisure activities. Increasingly, many scholars argue for making learning playful and pleasurable. Nørgård *et al.* (2017) maintain that computer gameful approaches need to be emphasized in education institutions due to the growing disengagement and loss of motivation amongst students due to poor pedagogy, and stressful learning environments among others. Other scholars including Davis *et al.* (1989); Venkatesh and Bala (2008); Tagoe (2012), found similar results in their studies.

This finding is of significant consequence to way universities plan their curriculum and pedagogy. This evidence requires universities to blend learning with educational games and play activities. Unfortunately, educationists tend to believe that such activities are for pre-primary classes. It is however critical to note that anything playful or pleasurable should not be construed to be educative and should not be taken to be emphasized in the curriculum for universities. Moreover, this finding should be interpreted with caution given that the benefits of playfulness to learning and teaching tend to be short-term (Deci *et al.* (2001); Boyle *et al.* (2016). Therefore, lasting impacts would be derived from such e-learning systems that take care of both extrinsic and intrinsic motivations to learning.

## 7.4 Subject Norm (SN) and Intention To Use Gamified E-Learning Systems.

From the results, Subject Norm (SN) positively influences the students' intention to use gamified e-learning systems. SN was measured by a number of items that relate to perceived social pressure to adopt or not adopt gamified e-learning systems in universities. This finding therefore means that positive social influence particularly of fellow students increases the likelihood of an individual student's decision to adopt new technology systems. This on the backdrop that subjective norms tend to shape the attitudes of users towards adopting new behaviours (Shih and Fang, 2004). (Davis *et al.*, 1989; Venkatesh and Bala, 2008) and (Al-Harbi, 2011b).

Other studies indicate that the effects of subjective norm on intention to use new technology systems are moderated by gender and time. Compared to men, women are more likely to be influenced by subject norms. In their study that investigated Gender, Social influence, and their influence on technology acceptance and usage behaviour, Venkatesh and Morris (2000) concluded that women's attitudes toward adopting new technology were more highly influenced by peer and social pressures compared to men. Moreover, the same study indicates that in as much as subjective norms positively influence adoption of new technology, it only lasts for a short time.

The above discussion is of significant importance to the universities of Saudi Arabia in their quest to move towards e-learning systems. Foremost, the key message is that Saudi universities need to take care of the popular norms of the students' community and as well anticipate the dynamics within such norms to inform decisions for adopting gamified e-learning systems.

## 7.5 The use of Game Elements and Intention To Use Gamified E-learning Systems.

Game Elements (GE) positively influence students' intention to use gamified e-learning systems. This result was hypothesized and expected. GE emphasized the use of games contain features or components including those for fun and reward that actively engage learners and enhance their learning. This result therefore means that e-learning systems that provide for more game elements create extrinsic motivation for the learner to participate actively in learning through such elements. This finding is in alignment with the findings of some of the earlier studies reviewed. de-Marcos *et al.* (2014) in their empirical study comparing gamification and social networking on e-learning indicate that gamified e-learning merges fun and reward into learning which are critical elements for improving learner engagement.

This finding provides evidence to Saudi universities to seriously consider game elements within their gamified learning environments. Game elements or features that improve learner fun and engagement should be the focus. Hamari *et al.* (2014) and Pedreira *et al.* (2015) advise on the different game elements that should be considered in establishing gamified e-learning systems. They suggest the following game elements: avatar, badges, challenges/tasks, leader boards, levels, point scoring, progression, ranking, rewards, roles, and users among others. It is however critical to be aware of the game elements that are of specific interest to the learners in the university. This requires a needs assessment before final decisions can be made on which kind of game elements to be included on the gamified e-learning system.

## 7.6 Computer Self-Efficacy (CSE) and Intention To Use Gamified E-learning Systems

Computer self-efficacy (CSE) was found to be the most influential factor of Intention to Use gamified e-learning systems. This is based on the size of the standardized beta coefficient ($\beta=0.37$) and high critical ratio (CR=4.8). This conclusion contradicts the findings of (Al-Harbi, 2011a) which found marginal impacts of the CSE on intention to adopt new technology systems. Nonetheless, the findings confirmed the hypothesis that CSE positively influences the students' intention to use gamified e-learning systems. This factor is measured by 6 items covering various aspects of learner's self-perceived capacity to use the computer. Therefore, this result means that students who perceive themselves as having more experience in computer skills are more likely adopt new e-learning technologies. This is on the backdrop that e-learning technologies including gamified systems assume a threshold of skills for one to adopt them. The current finding builds on earlier evidence by Bandura and Wessels (1997) who found that users who have a positive outlook of themselves in terms of ability to use computers tend to be more adaptive to new technologies. Other studies which found a positive relationship between CSE and ITU include (Davis *et al.*, 1989), (Venkatesh and Bala, 2008), Tagoe (2012) and (Seifert, 2004)

This finding has significant ramifications for Saudi universities. Foremost, they must invest in enabling their students to become skilled in computer and IT use so as to have a positive self-perception of computer skills mastery. This would improve on the likelihood of the students to adopt gamified e-learnring systems. Secondly, there is need to have a university specific computer skills audit amongst the studients to identify those that percieve themselves as highly competent and those who have negative outlook of themselves in terms of computer and IT skill. This would inform any strategy to fill the skills gaps as a precondition towards creating self-efficacious student with less resistence to adopting new technologies.

# Chapter 8: Conclusion and Recommendations

This research emerges out of the realization that universities face many challenges in trying to provide quality and equitable learning to the ever-increasing student numbers efficiently. As noted from literature, most of the challenges relate to limited financing, infrastructure and space, human resources and instruction materials, amidst declining higher education budgets. Moreover, this necessitates among others rethinking the delivery of higher education. The research holds a thesis that advancements in information and communication technology (ICT) have created more opportunities for universities to complement the traditional classroom to deliver their curricular. From the literature, it emerges that e-learning systems are being looked up to as the strategic direction to ameliorate some of the challenges faced by universities in Saudi Arabia. Nonetheless, there are acknowledged barriers limiting Saudi Universities from fully adopting e-learning systems. There is evidence to suggest that students' unwillingness or resistance to adopt the e-learning systems is the most influential factor and needs to be addressed with urgency.

This work therefore undertook to contribute to this growing area of research by investigating the factors that affect students' acceptance of gamified e-learning systems in Saudi Arabian universities. The research is based on the assumption that intention to use gamified e-learning systems in universities is attributable to various students' perceptions that shape their attitudes towards the use of gamified learning systems. However, the research identified clear gaps within the literature in the context of Saudi Arabia. Foremost, few of the studies on adoption of e-learning systems give essential attention to what exactly makes students resist adoption of e-learning systems. Rather, most of the studies end at identifying it as a barrier to adoption of e-learning systems.

The findings are significantly aligned to the study hypotheses stated earlier, save for a few that did turnout to the contrary. The study took the following hypotheses with regards to the factors that explain students' intention to use (ITU) gamified e-learning systems:

H1. Perceived usefulness (PU) of gamified e-learning system is positively associated with the students' Intention To Use (ITU) the gamified e-learning system.

H2. Image (IMG) is positively associated with the students' Intention To Use (ITU) the gamified e-learning system.

H3. Pleasure (PLS) derived from using gamified e-learning system is positively associated with the students' Intention To Use (ITU) the gamified e-learning system.

H4. Subject Norm (SN) is positively associated with the students' Intention To Use (ITU) the gamified e-learning system.

H5. The use of Game Elements is positively associated with the students' Intention To Use (ITU) the gamified e-learning system.

H6. Computer Self-Efficacy (CSE) is positively associated with the students' Intention To Use (ITU) the gamified e-learning system.

Save for hypothesis 2 (H2), the rest of the hypotheses were supported.

## 8.1 The study findings and the suggested conceptual model

As earlier highlighted in chapter 6, GELSAF3 was suggested arising from the literature review, expert interviews and students' questionnaire. The GELSAF3 contained various factors that were originally singled out as the most important determinants of intention to use gamified e-learning systems. These included attitudes towards behaviour, gender, experience in IT, computer self-efficacy, computer playfulness, subjective norm, image, perceived usefulness, perceived ease of use, perceived enjoyment, facilitating conditions, user interface language and game elements.

The exploratory factor analysis and structural equation models reclassified and validated five factors within the GELSAF3 as being significant in explaining students' intention to adopt gamified e-learning systems. These include perceived usefulness (PU), Pleasure (PLS), Subjective Norms (SN), Game Elements (GE), and Computer Self-Efficacy (CSE). It can therefore be concluded that whereas there was significant alignment of the final results and the suggested conceptual model, there were equally some deviations from it. The deviations were mainly related to the classifications of the factors and the hypothesised relationship.

## 8.2 Contributions and implications of the study findings

This study greatly contributes to a clearer understanding of the factors influencing students' acceptance of e learning systems in the context of the universities of Saudi Arabia. This study has provided sound evidence on why students at the Saudi Arabian Universities may react differently towards the implementation of gamified e-learning system. Specifically, the study has made it clear that perceived usefulness, pleasure derived from using gamified e-learning system, subject norm, game elements and computer self-efficacy significantly influence students' acceptance of e-learning in Saudi Arabian Universities. This evidence is critical at a time when there is a surge in the demand for higher education in Saudi Arabia and an increase in the demand for other modes of study that depend on technology. Moreover, the study provides the basis for universities to blend traditional classroom practices with non-classroom teaching and learning practices in order to guarantee more access to higher education.

The study contributes to theory development in such a way that it validates and at the same time improves the available theories that are used to predict information technology acceptance. Foremost, the study findings presuppose that there is no single technology acceptance theory that fully explains human behaviour towards adoption of new information technology. Rather, each theory contributes to the understanding but inadequate in providing a full understanding of the phenomenon. To this end, this study validates the re-use of the Unified Theory of Acceptance and Use of Technology (UTAUT) as a framework to guide studies in this area. This is on the backdrop that it integrates various constructs from different models into one frame for studying technology adoption, just as this study did. Nonetheless, the findings of the current study have highlighted some inconsistences to the assumed definitions and classifications of constructs and linkages between the constructs by the present theories. This is critical in theory development as it reinforces the fact that context matters in application of theories.

In terms of policy, the study offers some guidance to the various stakeholders in the provision of higher education. From the findings, Perceived usefulness, pleasure derived from using e-learning systems, subjective norms, game elements and computer self-efficacy were found to explain the students' intention to adopt gamified e-learning systems significantly. A lot of policy implications arise out these findings. Foremost, there is need for a policy dedicated to planning for the adoption of e-learning that pays maximum attention to the variables that have been found to influence adoption of e-learning systems. For instance, there is need to provide for a needs assessment of the students with regards to their perceived usefulness of e-learning systems, computer skills and efficacy, the kind of game elements that they think would aid the teaching and learning, and the peer influences surrounding adoption of new technologies. Secondly, the findings of this study require universities to operate an open policy such that students can have more space to communicate their needs. Further, the findings demand policy guidelines on blended teaching and learning to cater for playful yet educative activities within e-learning framework to improve the teaching and learning experiences. At national level, there is need for the government to ensure adoption of proactive ICT policies and the effective implementation of ICT policies to promote e-learning in universities. Such policies should ensure that universities focus on the needs of the students in planning for adoption of e-learning systems.

The study also makes critical contributions the practice of e-learning. The findings suggest the following as the areas of critical concern for the higher education practitioners:

I. Focus on students' e-learning needs assessment:

Universities should focus on the needs of students with regards to e-learning to identify the key features that such an e-learning system should have if it is to be accepted. This information can be used to inform the design of the e-learning system to be introduced into universities. By doing so, the chances of students adopting the system will be higher than otherwise

II. Blend learning to make it interesting:

There is evidence to suggest that learners tend to be more engaged on tasks that are of interest to them. Blending traditional classroom methods of teaching and learning with ICT has been proved to be more effective in arousing learning to learn. To this end, the findings require practitioners, particularly the university faculty, to blend learning with educational games and play activities.

III. Understand and manage the popular norms of the students' community

From the results, it was found that adoption of new technologies is a function of peer and social pressures. This implies that individual decisions to adopt e-learning systems are mainly based on the perceptions and the general cultures of peer groups towards e-learning. To this end, higher education practitioners, particularly university faculty, must ensure that they understand the popular norms of the student community in order to understand their impact on adoption of new technologies. Also, plans should be in place to manage the norms to favour adoption of e-learning systems.

IV. Undertake critical research on game elements that influence teaching and learning:

There is evidence to suggest that game elements such as avatar, badges, challenges/tasks, leader boards, levels, point scoring, progression, ranking, rewards, roles, and users among others, affect the teaching and learning processes. This therefore necessitates the higher education practitioners to be abreast with the elements that can lead to big results in terms of teaching and learning. This is critical given that some studies have found particular game elements not to yield the required results on the teaching and learning processes. Additionally, all efforts aimed at identifying impactful game elements should entail meaningful dialogues with the students to establish the elements that students regard as impactful.

V. Invest in enabling students and university staff IT skills

From the findings, students who viewed themselves as skilled in computer use were more likely to adopt new e-learning technologies than those that doubted their computer skills. This is evidence to require universities to invest in ensuring that their learners and staff master computer skills before the introduction of e-learning systems. However, this will necessitate a university specific computer skills audit amongst the students to identify those that perceive themselves as highly competent and those who have negative outlook of themselves in terms of computer and IT skills. This would inform any strategy to fill the skills gaps as a precondition towards creating self-efficacious student with less resistance to adopting new technologies.

## 8.3 Limitations of the study

The limitations of this study relate mainly with the fact that it used a sample to study a widely manifesting phenomenon. Foremost, out of the more than 40 universities in Saudi Arabia, only 9 were sampled leaving out the majority. Equally, out of the tens of thousands of the students attending higher education in Saudi Arabia, only about 440 were sampled leaving out the rest. Whereas efforts were invested in ensuring that the sampling is representative of the population, sampling errors remain a risk in the study. This would therefore call for caution with trying to generalise the findings with the wider population of students and universities in Saudi Arabia.

Secondly, the findings of the current study were based on cross-sectional survey data and interview results all conducted at a point in time. This could mean that the currency of the findings is restricted to the point of collection given that human beings change all the time. This implies that this study could have been enriched by longitudinal data that would allow for monitoring consistency and stability in the results. It is critical to note that the author tried to discount this limitation by addressing perpetually occurring challenges that have no time limitations.

Finally, this study assumed fixed effects of the factors that influence learners' intention to use gamified e-learning systems. For instance, the effects between the factors and intention to adopt gamified e-learning systems were assumed to be equal across the various universities and individual learner characteristics. Yet, it might be the case that factors affect the universities and individual learners differently.

## 8.4 Recommendations for further research

To address some of the limitations of this study, it would be logical to test the findings of this study using a much bigger sample than that considered here to test for consistency and stability of the findings. Further, it could be important to extend this study to explore the random effects of the factors that influence adoption of e-learning technologies. For instance, there is need to establish which universities and individual learners are more affected by the various factors. This points to location and gender differentials in the effects of the factors that influence students' intention to adopt new technologies. Also, given that image factor was not significant in this study, further investigation is warranted to confirm its effect on the students' intention to adopt e-learning systems.

Furthermore, it would be worthwhile to investigate the resulted framework (GELSAF3) of this research with a different and wider set of data, by considering different universities in Saudi Arabia. It is also recommended that applying the GELSAF3 in real world settings by conducting additional case studies in different universities which would provide more effective results to support the accuracy of the framework.

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# Appendix A

## A.1 The independent sample t-test for the gender factor

| Independent Samples Test | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
| | | F | Sig. | t | df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
| | | | | | | | | | Lower | Upper |
| CP | Equal variances assumed | .169 | .682 | 1.402 | 56 | .166 | .275 | .196 | -.118 | .667 |
| | Equal variances not assumed | | | 1.441 | 51.359 | .156 | .275 | .191 | -.108 | .657 |
| ITExp | Equal variances assumed | .001 | .971 | 1.722 | 56 | .091 | .404 | .234 | -.066 | .873 |
| | Equal variances not assumed | | | 1.728 | 47.795 | .090 | .404 | .234 | -.066 | .873 |
| CSE1 | Equal variances assumed | 2.447 | .123 | 1.688 | 56 | .097 | .417 | .247 | -.078 | .913 |
| | Equal variances not assumed | | | 1.845 | 55.976 | .070 | .417 | .226 | -.036 | .871 |
| CSE2 | Equal variances assumed | 2.171 | .146 | 1.059 | 56 | .294 | .214 | .202 | -.191 | .618 |
| | Equal variances not assumed | | | .974 | 34.494 | .337 | .214 | .219 | -.232 | .659 |
| ATB1 | Equal variances assumed | .439 | .510 | .119 | 56 | .906 | .020 | .167 | -.314 | .354 |
| | Equal variances not assumed | | | .122 | 50.516 | .904 | .020 | .163 | -.308 | .348 |
| ATB2 | Equal variances | .262 | .611 | -1.190 | 56 | .239 | -.211 | .177 | -.567 | .144 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | assumed | | | | | | | | | |
| | Equal variances not assumed | | | -1.184 | 46.373 | .243 | -.211 | .178 | -.570 | .148 |
| SN1 | Equal variances assumed | .694 | .408 | .815 | 56 | .418 | .159 | .195 | -.232 | .550 |
| | Equal variances not assumed | | | .803 | 44.877 | .426 | .159 | .198 | -.240 | .558 |
| SN2 | Equal variances assumed | 8.488 | .005 | 2.121 | 56 | .038 | .675 | .318 | .037 | 1.312 |
| | Equal variances not assumed | | | 1.981 | 36.589 | .055 | .675 | .340 | -.016 | 1.365 |
| IMG1 | Equal variances assumed | .202 | .655 | 1.841 | 56 | .071 | .460 | .250 | -.041 | .960 |
| | Equal variances not assumed | | | 1.773 | 41.204 | .084 | .460 | .259 | -.064 | .983 |
| IMG2 | Equal variances assumed | 2.681 | .107 | 1.834 | 56 | .072 | .412 | .225 | -.038 | .863 |
| | Equal variances not assumed | | | 1.895 | 52.108 | .064 | .412 | .218 | -.024 | .849 |
| PU1 | Equal variances assumed | .243 | .624 | -.522 | 56 | .603 | -.101 | .193 | -.487 | .285 |
| | Equal variances not assumed | | | -.510 | 43.303 | .613 | -.101 | .197 | -.499 | .297 |
| PU2 | Equal variances assumed | .533 | .468 | -.439 | 56 | .662 | -.084 | .192 | -.470 | .301 |
| | Equal variances not assumed | | | -.449 | 50.797 | .655 | -.084 | .188 | -.462 | .293 |
| PEoU1 | Equal variances assumed | .027 | .870 | .000 | 56 | 1.000 | .000 | .183 | -.366 | .366 |
| | Equal variances not assumed | | | .000 | 47.801 | 1.000 | .000 | .182 | -.366 | .366 |
| PEoU2 | Equal variances assumed | 4.754 | .033 | .171 | 56 | .865 | .031 | .181 | -.332 | .395 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Equal variances not assumed | | | .157 | 34.545 | .876 | .031 | .197 | -.369 | .432 |
| PEnj1 | Equal variances assumed | .308 | .581 | -.996 | 56 | .324 | -.199 | .200 | -.599 | .201 |
| | Equal variances not assumed | | | -.948 | 39.331 | .349 | -.199 | .210 | -.623 | .225 |
| PEnj2 | Equal variances assumed | 6.686 | .012 | -1.572 | 56 | .122 | -.393 | .250 | -.893 | .108 |
| | Equal variances not assumed | | | -1.438 | 33.801 | .160 | -.393 | .273 | -.947 | .162 |
| FC1 | Equal variances assumed | 2.282 | .136 | -.118 | 56 | .906 | -.027 | .231 | -.489 | .435 |
| | Equal variances not assumed | | | -.124 | 54.079 | .901 | -.027 | .220 | -.467 | .413 |
| FC2 | Equal variances assumed | .047 | .828 | -.981 | 56 | .331 | -.196 | .200 | -.597 | .205 |
| | Equal variances not assumed | | | -.978 | 46.747 | .333 | -.196 | .201 | -.600 | .208 |
| GE1 | Equal variances assumed | .920 | .342 | -.078 | 56 | .938 | -.011 | .144 | -.299 | .277 |
| | Equal variances not assumed | | | -.075 | 40.508 | .941 | -.011 | .150 | -.314 | .292 |
| GE2 | Equal variances assumed | 1.479 | .229 | -.507 | 56 | .614 | -.082 | .162 | -.406 | .242 |
| | Equal variances not assumed | | | -.482 | 39.181 | .632 | -.082 | .170 | -.426 | .262 |
| UIL1 | Equal variances assumed | .914 | .343 | 1.172 | 56 | .246 | .289 | .247 | -.205 | .784 |
| | Equal variances not assumed | | | 1.246 | 55.096 | .218 | .289 | .232 | -.176 | .755 |
| UIL2 | Equal variances assumed | .693 | .409 | .338 | 56 | .736 | .073 | .217 | -.361 | .507 |
| | Equal variances | | | .355 | 53.835 | .724 | .073 | .207 | -.341 | .488 |

| | not assumed | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|

## A.2 Correlations

**Descriptive Statistics**

| | Mean | Std. Deviation | N |
|---|---|---|---|
| Gen | .60 | .493 | 58 |
| CP | 4.03 | .725 | 58 |
| ITExp | 4.02 | .888 | 58 |
| CSE1 | 3.97 | .936 | 58 |
| CSE2 | 3.83 | .752 | 58 |
| ATB1 | 4.38 | .616 | 58 |
| ATB2 | 4.34 | .664 | 58 |
| SN1 | 4.03 | .725 | 58 |
| SN2 | 2.81 | 1.221 | 58 |
| IMG1 | 3.90 | .949 | 58 |
| IMG2 | 3.62 | .855 | 58 |
| PU1 | 4.02 | .713 | 58 |
| PU2 | 4.14 | .712 | 58 |
| PU3 | 4.14 | .782 | 58 |
| PEoU1 | 4.00 | .675 | 58 |
| PEoU2 | 4.16 | .670 | 58 |
| PEnj1 | 4.21 | .744 | 58 |
| PEnj2 | 3.76 | .942 | 58 |
| FC1 | 4.10 | .852 | 58 |
| FC2 | 4.38 | .745 | 58 |
| FC3 | 4.33 | .659 | 58 |
| GE1 | 4.22 | .531 | 58 |
| GE2 | 4.31 | .598 | 58 |
| UIL1 | 4.09 | .923 | 58 |
| UIL2 | 4.09 | .801 | 58 |

**Correlations**

| | | |
|---|---|---|
| Gen | Pearson Correlation | 1 |
| | Sig. (2-tailed) | |
| | N | 58 |
| CP | Pearson Correlation | -.206 |
| | Sig. (2-tailed) | .120 |

| | | |
|---|---|---|
| | N | 58 |
| ITExp | Pearson Correlation | -.224 |
| | Sig. (2-tailed) | .091 |
| | N | 58 |
| CSE1 | Pearson Correlation | -.220 |
| | Sig. (2-tailed) | .097 |
| | N | 58 |
| CSE2 | Pearson Correlation | -.140 |
| | Sig. (2-tailed) | .294 |
| | N | 58 |
| ATB1 | Pearson Correlation | -.016 |
| | Sig. (2-tailed) | .906 |
| | N | 58 |
| ATB2 | Pearson Correlation | .157 |
| | Sig. (2-tailed) | .239 |
| | N | 58 |
| SN1 | Pearson Correlation | -.108 |
| | Sig. (2-tailed) | .418 |
| | N | 58 |
| SN2 | Pearson Correlation | -.273* |
| | Sig. (2-tailed) | .038 |
| | N | 58 |
| IMG1 | Pearson Correlation | -.239 |
| | Sig. (2-tailed) | .071 |
| | N | 58 |
| IMG2 | Pearson Correlation | -.238 |
| | Sig. (2-tailed) | .072 |
| | N | 58 |
| PU1 | Pearson Correlation | .070 |
| | Sig. (2-tailed) | .603 |
| | N | 58 |
| PU2 | Pearson Correlation | .059 |
| | Sig. (2-tailed) | .662 |
| | N | 58 |
| PEoU1 | Pearson Correlation | .000 |
| | Sig. (2-tailed) | 1.000 |
| | N | 58 |
| PEoU2 | Pearson Correlation | -.023 |
| | Sig. (2-tailed) | .865 |

| | | |
|---|---|---|
| | N | 58 |
| PEnj1 | Pearson Correlation | .132 |
| | Sig. (2-tailed) | .324 |
| | N | 58 |
| PEnj2 | Pearson Correlation | .206 |
| | Sig. (2-tailed) | .122 |
| | N | 58 |
| FC1 | Pearson Correlation | .016 |
| | Sig. (2-tailed) | .906 |
| | N | 58 |
| FC2 | Pearson Correlation | .130 |
| | Sig. (2-tailed) | .331 |
| | N | 58 |
| GE1 | Pearson Correlation | .010 |
| | Sig. (2-tailed) | .938 |
| | N | 58 |
| GE2 | Pearson Correlation | .068 |
| | Sig. (2-tailed) | .614 |
| | N | 58 |
| UIL1 | Pearson Correlation | -.155 |
| | Sig. (2-tailed) | .246 |
| | N | 58 |
| UIL2 | Pearson Correlation | -.045 |
| | Sig. (2-tailed) | .736 |
| | N | 58 |

# Appendix B Oneway ANOVA for experience in IT

**Descriptives**

| | | | | | | 95% Confidence Interval for Mean | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | N | Mean | Std. Deviation | Std. Error | Lower Bound | Upper Bound | Minimum | Maximum |
| ITExp | 0 | 77 | .00 | .000 | .000 | .00 | .00 | 0 | 0 |
| | 1 | 11 | 1.36 | .505 | .152 | 1.02 | 1.70 | 1 | 2 |
| | 2 | 21 | 1.71 | .845 | .184 | 1.33 | 2.10 | 1 | 3 |
| | 3 | 9 | 1.56 | .726 | .242 | 1.00 | 2.11 | 1 | 3 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 4 | 17 | 1.71 | .772 | .187 | 1.31 | 2.10 | 1 | 3 |
| | Total | 135 | .70 | .941 | .081 | .54 | .86 | 0 | 3 |
| CSE1 | 0 | 77 | 3.70 | 1.001 | .114 | 3.47 | 3.93 | 1 | 5 |
| | 1 | 11 | 4.00 | .775 | .234 | 3.48 | 4.52 | 3 | 5 |
| | 2 | 21 | 3.95 | .973 | .212 | 3.51 | 4.40 | 1 | 5 |
| | 3 | 9 | 4.22 | .833 | .278 | 3.58 | 4.86 | 3 | 5 |
| | 4 | 17 | 3.82 | 1.074 | .261 | 3.27 | 4.38 | 1 | 5 |
| | Total | 135 | 3.81 | .979 | .084 | 3.65 | 3.98 | 1 | 5 |
| CSE2 | 0 | 77 | 3.82 | 1.035 | .118 | 3.58 | 4.05 | 1 | 5 |
| | 1 | 11 | 3.82 | .603 | .182 | 3.41 | 4.22 | 3 | 5 |
| | 2 | 21 | 3.76 | .889 | .194 | 3.36 | 4.17 | 2 | 5 |
| | 3 | 9 | 3.89 | .782 | .261 | 3.29 | 4.49 | 3 | 5 |
| | 4 | 17 | 3.88 | .697 | .169 | 3.52 | 4.24 | 2 | 5 |
| | Total | 135 | 3.82 | .921 | .079 | 3.67 | 3.98 | 1 | 5 |
| ATB1 | 0 | 77 | 4.26 | .733 | .084 | 4.09 | 4.43 | 2 | 5 |
| | 1 | 11 | 4.36 | .505 | .152 | 4.02 | 4.70 | 4 | 5 |
| | 2 | 21 | 4.38 | .669 | .146 | 4.08 | 4.69 | 3 | 5 |
| | 3 | 9 | 4.56 | .726 | .242 | 4.00 | 5.11 | 3 | 5 |
| | 4 | 17 | 4.29 | .588 | .143 | 3.99 | 4.60 | 3 | 5 |
| | Total | 135 | 4.31 | .685 | .059 | 4.19 | 4.43 | 2 | 5 |
| ATB2 | 0 | 77 | 4.12 | .917 | .105 | 3.91 | 4.33 | 1 | 5 |
| | 1 | 11 | 4.45 | .820 | .247 | 3.90 | 5.01 | 3 | 5 |
| | 2 | 21 | 4.24 | .625 | .136 | 3.95 | 4.52 | 3 | 5 |
| | 3 | 9 | 4.56 | .726 | .242 | 4.00 | 5.11 | 3 | 5 |
| | 4 | 17 | 4.29 | .588 | .143 | 3.99 | 4.60 | 3 | 5 |
| | Total | 135 | 4.21 | .823 | .071 | 4.07 | 4.35 | 1 | 5 |
| SN1 | 0 | 77 | 3.82 | .790 | .090 | 3.64 | 4.00 | 2 | 5 |
| | 1 | 11 | 4.27 | .647 | .195 | 3.84 | 4.71 | 3 | 5 |
| | 2 | 21 | 4.05 | .740 | .161 | 3.71 | 4.38 | 3 | 5 |
| | 3 | 9 | 3.78 | .972 | .324 | 3.03 | 4.52 | 3 | 5 |
| | 4 | 17 | 4.00 | .612 | .149 | 3.69 | 4.31 | 3 | 5 |
| | Total | 135 | 3.91 | .767 | .066 | 3.78 | 4.04 | 2 | 5 |
| SN2 | 0 | 77 | 2.48 | 1.071 | .122 | 2.24 | 2.72 | 1 | 5 |
| | 1 | 11 | 2.64 | 1.286 | .388 | 1.77 | 3.50 | 1 | 5 |
| | 2 | 21 | 3.05 | 1.244 | .271 | 2.48 | 3.61 | 1 | 5 |
| | 3 | 9 | 2.67 | 1.581 | .527 | 1.45 | 3.88 | 1 | 5 |
| | 4 | 17 | 2.71 | .985 | .239 | 2.20 | 3.21 | 1 | 4 |
| | Total | 135 | 2.62 | 1.145 | .099 | 2.43 | 2.82 | 1 | 5 |
| IMG1 | 0 | 77 | 3.62 | 1.136 | .129 | 3.37 | 3.88 | 1 | 5 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 11 | 4.09 | .831 | .251 | 3.53 | 4.65 | 3 | 5 |
| | 2 | 21 | 3.71 | 1.056 | .230 | 3.23 | 4.19 | 2 | 5 |
| | 3 | 9 | 4.44 | .882 | .294 | 3.77 | 5.12 | 3 | 5 |
| | 4 | 17 | 3.71 | .849 | .206 | 3.27 | 4.14 | 2 | 5 |
| | Total | 135 | 3.74 | 1.065 | .092 | 3.56 | 3.92 | 1 | 5 |
| IMG2 | 0 | 77 | 3.57 | 1.006 | .115 | 3.34 | 3.80 | 1 | 5 |
| | 1 | 11 | 3.55 | .934 | .282 | 2.92 | 4.17 | 2 | 5 |
| | 2 | 21 | 3.71 | .902 | .197 | 3.30 | 4.13 | 2 | 5 |
| | 3 | 9 | 3.78 | .833 | .278 | 3.14 | 4.42 | 3 | 5 |
| | 4 | 17 | 3.47 | .800 | .194 | 3.06 | 3.88 | 2 | 5 |
| | Total | 135 | 3.59 | .941 | .081 | 3.43 | 3.75 | 1 | 5 |
| PU1 | 0 | 77 | 4.00 | .874 | .100 | 3.80 | 4.20 | 1 | 5 |
| | 1 | 11 | 4.27 | .647 | .195 | 3.84 | 4.71 | 3 | 5 |
| | 2 | 21 | 3.90 | .831 | .181 | 3.53 | 4.28 | 2 | 5 |
| | 3 | 9 | 4.11 | .601 | .200 | 3.65 | 4.57 | 3 | 5 |
| | 4 | 17 | 3.94 | .659 | .160 | 3.60 | 4.28 | 3 | 5 |
| | Total | 135 | 4.01 | .806 | .069 | 3.87 | 4.14 | 1 | 5 |
| PU2 | 0 | 77 | 3.99 | 1.019 | .116 | 3.76 | 4.22 | 1 | 5 |
| | 1 | 11 | 4.00 | 1.000 | .302 | 3.33 | 4.67 | 2 | 5 |
| | 2 | 21 | 4.14 | .573 | .125 | 3.88 | 4.40 | 3 | 5 |
| | 3 | 9 | 4.11 | .782 | .261 | 3.51 | 4.71 | 3 | 5 |
| | 4 | 17 | 4.24 | .664 | .161 | 3.89 | 4.58 | 3 | 5 |
| | Total | 135 | 4.05 | .900 | .077 | 3.90 | 4.21 | 1 | 5 |
| PEoU1 | 0 | 77 | 3.81 | 1.026 | .117 | 3.57 | 4.04 | 1 | 5 |
| | 1 | 11 | 4.00 | .775 | .234 | 3.48 | 4.52 | 3 | 5 |
| | 2 | 21 | 4.00 | .632 | .138 | 3.71 | 4.29 | 3 | 5 |
| | 3 | 9 | 4.22 | .833 | .278 | 3.58 | 4.86 | 3 | 5 |
| | 4 | 17 | 3.88 | .600 | .146 | 3.57 | 4.19 | 3 | 5 |
| | Total | 135 | 3.89 | .895 | .077 | 3.74 | 4.04 | 1 | 5 |
| PEoU2 | 0 | 77 | 4.08 | .823 | .094 | 3.89 | 4.26 | 2 | 5 |
| | 1 | 11 | 4.18 | .751 | .226 | 3.68 | 4.69 | 3 | 5 |
| | 2 | 21 | 4.10 | .625 | .136 | 3.81 | 4.38 | 3 | 5 |
| | 3 | 9 | 4.56 | .527 | .176 | 4.15 | 4.96 | 4 | 5 |
| | 4 | 17 | 4.00 | .707 | .171 | 3.64 | 4.36 | 2 | 5 |
| | Total | 135 | 4.11 | .760 | .065 | 3.98 | 4.24 | 2 | 5 |
| PEnj1 | 0 | 77 | 4.09 | 1.015 | .116 | 3.86 | 4.32 | 1 | 5 |
| | 1 | 11 | 4.27 | .905 | .273 | 3.67 | 4.88 | 3 | 5 |
| | 2 | 21 | 4.19 | .814 | .178 | 3.82 | 4.56 | 2 | 5 |
| | 3 | 9 | 4.22 | .667 | .222 | 3.71 | 4.73 | 3 | 5 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 4 | 17 | 4.18 | .636 | .154 | 3.85 | 4.50 | 3 | 5 |
| | Total | 135 | 4.14 | .907 | .078 | 3.99 | 4.30 | 1 | 5 |
| PEnj2 | 0 | 77 | 3.69 | 1.067 | .122 | 3.45 | 3.93 | 1 | 5 |
| | 1 | 11 | 3.82 | .982 | .296 | 3.16 | 4.48 | 2 | 5 |
| | 2 | 21 | 3.48 | 1.123 | .245 | 2.96 | 3.99 | 1 | 5 |
| | 3 | 9 | 4.00 | 1.000 | .333 | 3.23 | 4.77 | 2 | 5 |
| | 4 | 17 | 3.94 | .556 | .135 | 3.66 | 4.23 | 3 | 5 |
| | Total | 135 | 3.72 | 1.012 | .087 | 3.55 | 3.89 | 1 | 5 |
| FC1 | 0 | 77 | 3.95 | .972 | .111 | 3.73 | 4.17 | 2 | 5 |
| | 1 | 11 | 3.82 | .874 | .263 | 3.23 | 4.41 | 3 | 5 |
| | 2 | 21 | 4.43 | .676 | .148 | 4.12 | 4.74 | 3 | 5 |
| | 3 | 9 | 3.89 | .928 | .309 | 3.18 | 4.60 | 2 | 5 |
| | 4 | 17 | 4.00 | .935 | .227 | 3.52 | 4.48 | 2 | 5 |
| | Total | 135 | 4.01 | .922 | .079 | 3.86 | 4.17 | 2 | 5 |
| FC2 | 0 | 77 | 4.38 | .918 | .105 | 4.17 | 4.59 | 1 | 5 |
| | 1 | 11 | 4.45 | .820 | .247 | 3.90 | 5.01 | 3 | 5 |
| | 2 | 21 | 4.29 | .717 | .156 | 3.96 | 4.61 | 3 | 5 |
| | 3 | 9 | 4.22 | 1.093 | .364 | 3.38 | 5.06 | 2 | 5 |
| | 4 | 17 | 4.53 | .514 | .125 | 4.26 | 4.79 | 4 | 5 |
| | Total | 135 | 4.38 | .845 | .073 | 4.23 | 4.52 | 1 | 5 |
| GE1 | 0 | 77 | 4.18 | .839 | .096 | 3.99 | 4.37 | 1 | 5 |
| | 1 | 11 | 4.27 | .647 | .195 | 3.84 | 4.71 | 3 | 5 |
| | 2 | 21 | 4.24 | .436 | .095 | 4.04 | 4.44 | 4 | 5 |
| | 3 | 9 | 4.44 | .527 | .176 | 4.04 | 4.85 | 4 | 5 |
| | 4 | 17 | 4.06 | .556 | .135 | 3.77 | 4.34 | 3 | 5 |
| | Total | 135 | 4.20 | .721 | .062 | 4.08 | 4.32 | 1 | 5 |
| GE2 | 0 | 77 | 4.17 | .865 | .099 | 3.97 | 4.37 | 2 | 5 |
| | 1 | 11 | 4.45 | .688 | .207 | 3.99 | 4.92 | 3 | 5 |
| | 2 | 21 | 4.33 | .577 | .126 | 4.07 | 4.60 | 3 | 5 |
| | 3 | 9 | 4.56 | .527 | .176 | 4.15 | 4.96 | 4 | 5 |
| | 4 | 17 | 4.06 | .556 | .135 | 3.77 | 4.34 | 3 | 5 |
| | Total | 135 | 4.23 | .762 | .066 | 4.10 | 4.36 | 2 | 5 |
| UIL1 | 0 | 77 | 4.03 | .959 | .109 | 3.81 | 4.24 | 2 | 5 |
| | 1 | 11 | 3.82 | 1.250 | .377 | 2.98 | 4.66 | 1 | 5 |
| | 2 | 21 | 4.33 | .658 | .144 | 4.03 | 4.63 | 3 | 5 |
| | 3 | 9 | 4.22 | .972 | .324 | 3.48 | 4.97 | 3 | 5 |
| | 4 | 17 | 3.88 | .928 | .225 | 3.41 | 4.36 | 2 | 5 |
| | Total | 135 | 4.05 | .941 | .081 | 3.89 | 4.21 | 1 | 5 |
| UIL2 | 0 | 77 | 4.03 | .827 | .094 | 3.84 | 4.21 | 2 | 5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 11 | 4.18 | 1.168 | .352 | 3.40 | 4.97 | 2 | 5 |
| 2 | 21 | 4.05 | .669 | .146 | 3.74 | 4.35 | 3 | 5 |
| 3 | 9 | 4.22 | .667 | .222 | 3.71 | 4.73 | 3 | 5 |
| 4 | 17 | 4.00 | .791 | .192 | 3.59 | 4.41 | 3 | 5 |
| Total | 135 | 4.05 | .813 | .070 | 3.91 | 4.19 | 2 | 5 |

**Test of Homogeneity of Variances**

| | Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|---|
| ITExp | 85.404 | 4 | 130 | .000 |
| CSE1 | 1.245 | 4 | 130 | .295 |
| CSE2 | 2.679 | 4 | 130 | .035 |
| ATB1 | .743 | 4 | 130 | .564 |
| ATB2 | 1.196 | 4 | 130 | .316 |
| SN1 | 2.467 | 4 | 130 | .048 |
| SN2 | 1.330 | 4 | 130 | .262 |
| IMG1 | 1.619 | 4 | 130 | .173 |
| IMG2 | .432 | 4 | 130 | .785 |
| PU1 | .433 | 4 | 130 | .784 |
| PU2 | 1.241 | 4 | 130 | .297 |
| PEoU1 | 2.988 | 4 | 130 | .021 |
| PEoU2 | 1.384 | 4 | 130 | .243 |
| PEnj1 | 1.769 | 4 | 130 | .139 |
| PEnj2 | 3.868 | 4 | 130 | .005 |
| FC1 | .755 | 4 | 130 | .556 |
| FC2 | 1.448 | 4 | 130 | .222 |
| GE1 | 3.198 | 4 | 130 | .015 |
| GE2 | 3.495 | 4 | 130 | .010 |
| UIL1 | 1.755 | 4 | 130 | .142 |
| UIL2 | 1.370 | 4 | 130 | .248 |

**ANOVA**

| | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| ITExp | Between Groups | 87.965 | 4 | 21.991 | 93.480 | .000 |
| | Within Groups | 30.583 | 130 | .235 | | |
| | Total | 118.548 | 134 | | | |
| CSE1 | Between Groups | 3.262 | 4 | .815 | .847 | .498 |
| | Within Groups | 125.108 | 130 | .962 | | |
| | Total | 128.370 | 134 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| CSE2 | Between Groups | .179 | 4 | .045 | .051 | .995 |
| | Within Groups | 113.554 | 130 | .873 | | |
| | Total | 113.733 | 134 | | | |
| ATB1 | Between Groups | .879 | 4 | .220 | .460 | .765 |
| | Within Groups | 62.055 | 130 | .477 | | |
| | Total | 62.933 | 134 | | | |
| ATB2 | Between Groups | 2.534 | 4 | .633 | .933 | .447 |
| | Within Groups | 88.236 | 130 | .679 | | |
| | Total | 90.770 | 134 | | | |
| SN1 | Between Groups | 2.789 | 4 | .697 | 1.190 | .318 |
| | Within Groups | 76.144 | 130 | .586 | | |
| | Total | 78.933 | 134 | | | |
| SN2 | Between Groups | 5.485 | 4 | 1.371 | 1.047 | .386 |
| | Within Groups | 170.248 | 130 | 1.310 | | |
| | Total | 175.733 | 134 | | | |
| IMG1 | Between Groups | 6.902 | 4 | 1.725 | 1.547 | .193 |
| | Within Groups | 145.024 | 130 | 1.116 | | |
| | Total | 151.926 | 134 | | | |
| IMG2 | Between Groups | .932 | 4 | .233 | .257 | .905 |
| | Within Groups | 117.661 | 130 | .905 | | |
| | Total | 118.593 | 134 | | | |
| PU1 | Between Groups | 1.171 | 4 | .293 | .444 | .777 |
| | Within Groups | 85.821 | 130 | .660 | | |
| | Total | 86.993 | 134 | | | |
| PU2 | Between Groups | 1.131 | 4 | .283 | .342 | .849 |
| | Within Groups | 107.506 | 130 | .827 | | |
| | Total | 108.637 | 134 | | | |
| PEoU1 | Between Groups | 1.935 | 4 | .484 | .597 | .666 |
| | Within Groups | 105.398 | 130 | .811 | | |
| | Total | 107.333 | 134 | | | |
| PEoU2 | Between Groups | 2.133 | 4 | .533 | .922 | .453 |
| | Within Groups | 75.201 | 130 | .578 | | |
| | Total | 77.333 | 134 | | | |
| PEnj1 | Between Groups | .516 | 4 | .129 | .153 | .961 |
| | Within Groups | 109.810 | 130 | .845 | | |
| | Total | 110.326 | 134 | | | |
| PEnj2 | Between Groups | 2.969 | 4 | .742 | .718 | .581 |
| | Within Groups | 134.335 | 130 | 1.033 | | |
| | Total | 137.304 | 134 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| FC1 | Between Groups | 4.510 | 4 | 1.128 | 1.339 | .259 |
| | Within Groups | 109.460 | 130 | .842 | | |
| | Total | 113.970 | 134 | | | |
| FC2 | Between Groups | .852 | 4 | .213 | .292 | .883 |
| | Within Groups | 94.882 | 130 | .730 | | |
| | Total | 95.733 | 134 | | | |
| GE1 | Between Groups | .991 | 4 | .248 | .469 | .758 |
| | Within Groups | 68.609 | 130 | .528 | | |
| | Total | 69.600 | 134 | | | |
| GE2 | Between Groups | 2.519 | 4 | .630 | 1.086 | .366 |
| | Within Groups | 75.363 | 130 | .580 | | |
| | Total | 77.881 | 134 | | | |
| UIL1 | Between Groups | 3.066 | 4 | .766 | .862 | .489 |
| | Within Groups | 115.571 | 130 | .889 | | |
| | Total | 118.637 | 134 | | | |
| UIL2 | Between Groups | .545 | 4 | .136 | .201 | .937 |
| | Within Groups | 88.092 | 130 | .678 | | |
| | Total | 88.637 | 134 | | | |

**Robust Tests of Equality of Means[b]**

| | | Statistic[a] | df1 | df2 | Sig. |
|---|---|---|---|---|---|
| ITExp | Welch | . | . | . | . |
| | Brown-Forsythe | . | . | . | . |
| CSE1 | Welch | .966 | 4 | 29.714 | .441 |
| | Brown-Forsythe | .949 | 4 | 65.346 | .442 |
| CSE2 | Welch | .067 | 4 | 31.316 | .991 |
| | Brown-Forsythe | .073 | 4 | 68.469 | .990 |
| ATB1 | Welch | .411 | 4 | 29.934 | .800 |
| | Brown-Forsythe | .537 | 4 | 54.316 | .709 |
| ATB2 | Welch | .934 | 4 | 30.134 | .458 |
| | Brown-Forsythe | 1.204 | 4 | 54.393 | .320 |
| SN1 | Welch | 1.309 | 4 | 29.104 | .290 |
| | Brown-Forsythe | 1.200 | 4 | 41.474 | .325 |
| SN2 | Welch | .908 | 4 | 27.675 | .473 |
| | Brown-Forsythe | .844 | 4 | 40.444 | .506 |
| IMG1 | Welch | 1.952 | 4 | 30.444 | .127 |
| | Brown-Forsythe | 1.980 | 4 | 67.785 | .107 |
| IMG2 | Welch | .301 | 4 | 29.631 | .875 |

| | | | | | |
|---|---|---|---|---|---|
| | Brown-Forsythe | .298 | 4 | 60.351 | .878 |
| PU1 | Welch | .604 | 4 | 30.811 | .662 |
| | Brown-Forsythe | .582 | 4 | 71.784 | .676 |
| PU2 | Welch | .439 | 4 | 30.018 | .780 |
| | Brown-Forsythe | .435 | 4 | 47.956 | .782 |
| PEoU1 | Welch | .625 | 4 | 30.487 | .648 |
| | Brown-Forsythe | .840 | 4 | 54.485 | .506 |
| PEoU2 | Welch | 1.605 | 4 | 30.521 | .198 |
| | Brown-Forsythe | 1.162 | 4 | 62.714 | .336 |
| PEnj1 | Welch | .151 | 4 | 30.747 | .961 |
| | Brown-Forsythe | .205 | 4 | 61.147 | .935 |
| PEnj2 | Welch | .934 | 4 | 29.753 | .458 |
| | Brown-Forsythe | .815 | 4 | 52.728 | .521 |
| FC1 | Welch | 1.982 | 4 | 29.219 | .124 |
| | Brown-Forsythe | 1.473 | 4 | 53.230 | .223 |
| FC2 | Welch | .454 | 4 | 29.482 | .768 |
| | Brown-Forsythe | .308 | 4 | 36.633 | .870 |
| GE1 | Welch | .778 | 4 | 30.930 | .548 |
| | Brown-Forsythe | .720 | 4 | 62.714 | .582 |
| GE2 | Welch | 1.673 | 4 | 31.195 | .181 |
| | Brown-Forsythe | 1.609 | 4 | 66.052 | .183 |
| UIL1 | Welch | 1.106 | 4 | 28.523 | .373 |
| | Brown-Forsythe | .800 | 4 | 42.236 | .532 |
| UIL2 | Welch | .204 | 4 | 28.938 | .934 |
| | Brown-Forsythe | .189 | 4 | 40.546 | .943 |

a. Asymptotically F distributed.

b. Robust tests of equality of means cannot be performed for ITExp because at least one group has 0 variance.

# Appendix C Expert Interview

Interview questions for e-learning experts in Saudi Arabian universities.

The aim of this research is to construct a framework for gamified e-learning systems acceptance by students at Saudi Arabian universities. You have been chosen to take part in this study for the reason that you are an expert in e-learning and, therefore, your opinion is considered important as it helps for better indication of the factors that affect students' intention to accept gamified e-learning systems at Saudi Arabian universities.

Please be informed that this research is under the direction of the Department of Electronics and Computer Science at the University of Southampton and your information will be used for the research purpose only.

I would appreciate your response to the following questions.

| | |
|---|---|
| Name | |
| Phone number | |
| Email | |

| To what extent do you agree that the following factors are important in affecting students' intention to accept gamified e-learning systems at Saudi Arabian universities? | Important | Not important | Comment |
|---|---|---|---|
| **1- Individual Factors**<br>This category includes all factors related to the individual him/herself. Students will communicate their attitudes towards the use of the system, their experience in IT, their gender, their age, their self efficacy towards computers, and whether they enjoy using the system. | | | |
| Attitudes towards behaviour | | | |
| Experience in IT | | | |
| Gender | | | |
| Age | | | |
| Computer Self-efficacy | | | |
| **2- Social Factors**<br>This category includes factors related to the feelings of the student. What does the student feel about what others say about him/her using the system, and how would the student's social status be affected after the use of the system? | | | |
| Subjective Norm | | | |
| Image (Social Status) | | | |
| **3- System Factors** | | | |

| | | | |
|---|---|---|---|
| This category includes all factors that are related to the system itself, where students assess the usefulness, easiness, and playfulness that they experience when using the system. | | | |
| Perceived Usefulness | | | |
| Perceived Ease of Use | | | |
| Perceived Enjoyment | | | |
| Computer Playfulness | | | |
| Facilitating Conditions | | | |
| **Questions related to the construction of the framework:** | | | |
| Could you please tell me what extra factors should be added? | | | |
| | | | |
| Could you please tell me what factors should be removed? | | | |
| | | | |
| Additional information | | | |
| | | | |

Thank you for your participation.

# Appendix D Student Questionnaire

A questionnaire for students in Saudi Arabian universities.

**Investigating the factors affecting the acceptance of gamified e-learning systems by students in Saudi universities**

**دراسة العوامل التي تؤثر على تقبّل الطلاب لأنظمة التعليم الترفيهي الإلكتروني في الجامعات السعودية**

شكراً لاهتمامك بالمشاركة في هذه الاستبانة وأقدر لك وقتك الثمين ومشاركتك القيّمة. يستغرق هذا الاستبيان خمسة دقائق تقريباً.

يهدف هذا البحث إلى دراسة العوامل المؤثرة على تقبل الطلاب والطالبات لأنظمة التعليم الترفيهي الإلكتروني والتي يتم إضافة الطابع الترفيهي لها مثل الموجود في الألعاب بحيث يتم إضافة بعض عناصر الألعاب مثل النقاط، الصور الشخصية، لوحة المتصدرين، وصندوق المحادثات إلى نظام التعليم الإلكتروني ليضفي عليه طابع ما يكون أشبه بالطابع الموجود في ألعاب الفيديو والألعاب الموجودة في الهواتف الذكية.

هذا البحث يهدف إلى دراسة ثلاثة نواحي وهي العوامل الفردية، الإجتماعية، والعوامل المتعلقة بالنظام. مشاركتك ستضيف إلى هذا البحث فائدة كبيرة حيث أنها سوف تساعد الباحث في تحديد العوامل الأكثر فعالية لتقبل الطلاب لأنظمة التعليم الترفيهي الإلكتروني والتي بالتالي ستفيد الجامعات السعودية في تحديد الإتجاهات المستقبلية لأنظمة التعليم الترفيهي الإلكتروني وستساعد أيضاً في تطوير هذا المجال.

لمزيد من المعلومات الرجاء زيارة الرابط التالي:

http://www.ecs.soton.ac.uk/people/aia1n15

شكراً جزيلاً لتعاونكم..

Thank you very much for your interest in taking this questionnaire, I appreciate your time and valuable participation; it should take about 5 minutes.

This research aims to investigate the factors that affect students' acceptance of gamified e-learning systems at Saudi universities. Gamified e-learning systems are systems that have been integrated with game elements such as points, avatars, leader board, and chat box to possess the game-design context so that they would be more like video games and smartphones games than just e-learning systems.

The factors have been categorised into three categories, which are individual, social, and system where each category contains at least two factors.

You have been chosen to take part in this questionnaire because your perception will help in indicating significant factors that affect the acceptance of gamified e-learning systems by students at Saudi universities.

Please be informed that this research is under the direction of the Department of Electronics and Computer Science at the University of Southampton and your information will be used for the research purpose only.

I would appreciate your response to the following questions.

Questions:

Part 1: General information

Please enter your email (this email will be used as an identifier if you decided to withdraw in future):

Click or tap here to enter text.

الرجاء إدخال البريد الإلكتروني(البريد الإلكتروني سيستخدم كمعرف في حال أردت أن تسحب مشاركتك في المستقبل):

Click or tap here to enter text.

Please enter the university where you study.

Click or tap here to enter text.

الرجاء إدخال أسم الجامعة:

Click or tap here to enter text.

Please enter the department/major.

Click or tap here to enter text.

الرجاء إدخال القسم أو التخصص:

Click or tap here to enter text.

Please select your gender (☐male/☐female).

الرجاء اختيار الجنس (☐ذكر / ☐أنثى)

Have you ever used e-learning systems before? (☐Yes/☐No)

How many years have you been using gamified e-learning systems?

- Less than a year
- Less than 2 years
- 2-5 years

Over 5 years

منذ متى وأنت تستخدم أنظمة التعليم الترفيهي الإلكتروني ؟

- أقل من سنة
- أقل من سنتين
- سنتان إلى خمس سنوات
- أكثر من خمس سنوات

| **To what extent do you agree with the following statement:**<br>**إلى أي مدى توافق أو لا توافق على العبارات التالية:** | **Strongly Disagree** | **Disagree** | **Neutral** | **Agree** | **Strongly Agree** |
|---|---|---|---|---|---|
| **Individual Factors العوامل الفردية** | | | | | |
| I could complete the job using a gamified e-learning system:<br>أستطيع إكمال المهمة باستخدام نظام تعليم ترفيهي إلكتروني:<br>Computer Self-Efficacy | | | | | |
| If there was no one around to tell me what to do as I go. | ☐ | ☐ | ☐ | ☐ | ☐ |

| | | | | | |
|---|---|---|---|---|---|
| دون الحاجة لوجود شخص حولي يقوم بتعليمي كيف أقوم بعمل ذلك. | Comment: | | | | |
| If I had just the built-in help facility for assistance. | ☐ | ☐ | ☐ | ☐ | ☐ |
| إذا كان هنالك مساعدة مدمجة يمكنني استخدامها للوصول لبعض التعليمات. | Comment: | | | | |
| if someone showed me how to do it first | ☐ | ☐ | ☐ | ☐ | ☐ |
| إذا قام شخص بتعليمي كيف أقوم بفعل ذلك. | Comment: | | | | |
| If I had used similar packages before this one to do the same job. | ☐ | ☐ | ☐ | ☐ | ☐ |
| إذا كنتُ قد استخدمت برامج مشابهة في الماضي. | Comment: | | | | |
| Accepting gamified e-learning systems will have positive effects on the educational process. | ☐ | ☐ | ☐ | ☐ | ☐ |
| تقبل التعليم الترفيهي الإلكتروني سوف يكون له آثار إيجابية على عملية التعليم. | Comment: | | | | |
| Gamified e-learning systems will provide an attractive learning environment. | ☐ | ☐ | ☐ | ☐ | ☐ |
| أنظمة التعليم الترفيهي الإلكترونية ستوفر بيئة تعليمية جذّابة. | Comment: | | | | |
| Accepting gamified e-learning systems will be a good idea. | ☐ | ☐ | ☐ | ☐ | ☐ |
| تقبل التعليم الترفيهي الإلكتروني سيكون فكرة جيدة. | Comment: | | | | |
| I am interested in using gamified e-learning systems. | ☐ | ☐ | ☐ | ☐ | ☐ |
| أنا مهتم وأرغب في استخدام أنظمة التعليم الترفيهي الإلكتروني. | Comment: | | | | |
| I think students with experience in IT will accept gamified e-learning .systems more than students who have no experience. | ☐ | ☐ | ☐ | ☐ | ☐ |
| أعتقد الطلاب ذو الخبرة في تقنية المعلومات سيتقبلون التعليم الترفيهي الإلكتروني أكثر من عديمي الخبرة. | Comment: | | | | |
| **Social Factors العوامل الإجتماعية** | | | | | |
| People who influence my behaviour would think I should accept gamified e-learning systems. | ☐ | ☐ | ☐ | ☐ | ☐ |
| الأشخاص المؤثرين في سلوكي سيفضلون لو أنني أتقبل أنظمة التعليم الترفيهي الإلكتروني. | Comment: | | | | |
| Most of those who are around me would think I should not accept | ☐ | ☐ | ☐ | ☐ | ☐ |

gamified e-learning systems.

Comment:

معضم الأشخاص الذين أعرفهم سيفضلون لو أنني أرفض أنظمة التعليم الترفيهي الإلكتروني.

| | | | | | |
|---|---|---|---|---|---|
| People who are important to me would think I should not accept gamified e-learning systems.<br>معضم الأشخاص الذين يهمني أمرهم سيفضلون لو أنني أرفض أنظمة التعليم الترفيهي الإلكتروني. | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Comment: | | | | |
| People whose opinions I value would think I should accept gamified e-learning systems.<br>الأشخاص الذين لرأيهم قيمة في حياتي سيفضلون لو أنني أتقبل أنظمة التعليم الترفيهي الإلكتروني. | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Comment: | | | | |
| I think that people who accept gamified e-learning systems are getting better education than those who do not.<br>باعتقادي أن الأشخاص الذين يتقبّلون التعليم الترفيهي الإلكتروني يحصلون على مستوى تعليم عالي أكثر من الأشخاص الذين لا يتقبلونه. | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Comment: | | | | |
| I think that people who accept gamified e-learning systems have good reputation.<br>باعتقادي أن الأشخاص الذين يتقبّلون التعليم الترفيهي الإلكتروني لديهم سمعة جيدة. | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Comment: | | | | |
| Accepting gamified e-learning systems is good for my reputation.<br>تقبل التعليم الترفيهي الإلكتروني يجعل سمعتي جيدة في المجتمع. | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Comment: | | | | |
| Students in my university who accept gamified e-learning systems are known and respected more than others.<br>الطلاب الذين يتقبلون التعليم الترفيهي الإلكتروني في جامعتي هم معروفين ويّحتَرمون أكثر من الآخرين. | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Comment: | | | | |

**عوامل النظام System Factors**

| | | | | | |
|---|---|---|---|---|---|
| Gamified e-learning systems will allow me to accomplish learning tasks more quickly.<br>أنظمة التعليم الترفيهي الإلكتروني ستتيح لي تحقيق مهامي التعليمية بشكل أسرع. | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Comment: | | | | |
| Gamified e-learning systems will improve my learning performance.<br>أنظمة التعليم الترفيهي الإلكتروني ستحسن من أدائي التعليمي. | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Comment: | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Gamified e-learning systems will make it easier to learn course content.<br>أنظمة التعليم الترفيهي الإلكتروني ستسهّل عليّ فهم المحتوى التعليمي. | ☐<br>Comment: | ☐ | ☐ | ☐ | ☐ |
| Accepting gamified e-learning systems will increase my learning productivity.<br>أنظمة التعليم الترفيهي الإلكتروني ستزيد من إنتاجي التعليمي. | ☐<br>Comment: | ☐ | ☐ | ☐ | ☐ |
| Accepting gamified e-learning systems will enhance my effectiveness in learning.<br>أنظمة التعليم الترفيهي الإلكتروني ستحسّن من فعاليّتي في التعليم. | ☐<br>Comment: | ☐ | ☐ | ☐ | ☐ |
| I find gamified e-learning systems useful in my learning.<br>أجد أنظمة التعليم الترفيهي الإلكتروني مفيدة في تعليمي. | ☐<br>Comment: | ☐ | ☐ | ☐ | ☐ |
| My interaction with gamified e-learning systems is clear and understandable.<br>تفاعلي مع أنظمة التعليم الترفيهي الإلكتروني واضح و مفهوم. | ☐<br>Comment: | ☐ | ☐ | ☐ | ☐ |
| Interacting with the gamified e-learning systems does not require a lot of my mental effort.<br>التفاعل مع أنظمة التعليم الترفيهي الإلكتروني لا يتطلّب الكثير من الجهد. | ☐<br>Comment: | ☐ | ☐ | ☐ | ☐ |
| I find the gamified e-learning systems to be easy to use.<br>أنا أجد أنظمة التعليم الترفيهي الإلكتروني سهلة الإستخدام. | ☐<br>Comment: | ☐ | ☐ | ☐ | ☐ |
| I find it easy to get the gamified e-learning system to do what I want it to do.<br>أنا أجد أنه من السّهل جعل نظام التعليم الترفيهي الإلكتروني يفعل ما يطلب منه. | ☐<br>Comment: | ☐ | ☐ | ☐ | ☐ |
| I find using the gamified e-learning systems to be enjoyable.<br>أنا أجد بأن أنظمة التعليم الترفيهي الإلكتروني مسلّية. | ☐<br>Comment: | ☐ | ☐ | ☐ | ☐ |
| The actual process of using the gamified e-learning systems is pleasant. | ☐<br>Comment: | ☐ | ☐ | ☐ | ☐ |

العملية الأساسية لاستخدام أنظمة التعليم الإلكتروني هي المتعة.

| | | | | | |
|---|---|---|---|---|---|
| I have fun using the gamified e-learning system.<br>أنا أستمتع باستخدام أنظمة التعليم الترفيهي الإلكتروني. | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Comment: | | | | |
| Gamified e-learning systems training courses are essential to accept the system.<br>الدورات التدريبية مهمّة بالنسبة لي كي أتقبّل أنظمة التعليم الترفيهي الإلكتروني. | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Comment: | | | | |
| University infrastructure is important to me to accept gamified e-learning systems.<br>البنية التحتية للجامعة مهمة بالنسبة لي لتقبّل أنظمة التعليم الترفيهي الإلكتروني. | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Comment: | | | | |
| I will accept gamified e-learning systems if IT Staff are available for supporting it.<br>سأتقبّل أنظمة التعليم الترفيهي الإلكتروني في حال تواجد فريق دعم تقنية المعلومات للمساعدة. | ☐ | ☐ | ☐ | ☐ | ☐ |
| | Comment: | | | | |

# Appendix E Visual representation of the final structural model