UNIVERSITY OF GHANA

COLLEGE OF HUMANITIES

INTEGRATED MODEL FOR TAILORING GAMIFIED INFORMATION SYSTEMS IN HIGHER EDUCATION INSTITUTIONS IN A DEVELOPING ECONOMY

BY

KINGSLEY OFOSU-AMPONG

(10247908)

THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF **PHD IN INFORMATION SYSTEMS** DEGREE.

DEPARTMENT OF OPERATIONS AND MANAGEMENT INFORMATION SYSTEMS

FEBRUARY 2023

DECLARATION

I certify that this thesis, which I now submit for examination for the award of a Doctor of Philosophy, is the result of my work and has never been presented either in whole or in part for any other degree at this University or elsewhere. All references to other people's work have been duly cited.

This thesis has been prepared according to the regulations for postgraduate study by the University.

8th February 2023

…….. ……

Kingsley Ofosu-Ampong Date

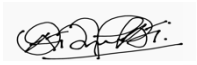
(Candidate)

..RICHARD BOATENG 8th February 2023

…… ……

Professor Richard Boateng Date

(Lead Supervisor)



8th February 2023

…… ……

Professor Thomas Anning-Dorson Date

(Co-Supervisor)

8th February 2023

…… ……

Dr. Emmanuel Awuni Kolog Date

(Co-Supervisor)

ABSTRACT

Gamification, a new concept for adding game design elements to make activities more engaging is pervading many information systems. As a multidisciplinary research area, gamification integrates human motivation, technology, task characteristics and human-computer interaction design. The motivation and fun surrounding gamified information systems (GIS) result from their potential benefits to institutions. However, a dearth of research and theory exists on how gamified interventions change behaviours in education, coupled with many challenges in conducting gamification research, particularly in developing economies (DE). Also, most of the GIS have been evaluated and adopted based on a one-size-fits-all approach. However, learners differ in their acceptance, motivation, engagement, and continuance use of technology. The thesis, therefore, examines the learner acceptance, engagement, and continuance use of GIS. Its purpose is to develop a theoretical and practical-oriented framework for tailoring gamification to a target audience in higher education institutions (HEIs) in Ghana. To achieve this purpose, the study employed three theories, namely, the Unified Theory of Acceptance and Use of Technology (UTAUT), the Self-Determination Theory (SDT) and the Motivation-Opportunity-Ability (MOA). Posited in the tenants of the positivist research paradigm, 30 hypotheses were developed and tested through a quantitative survey by comparing their predictions with the observed gamified data collected from 442 participants in an HEI in Ghana.

First, using the UTAUT theory, I investigated students' (n=185) gaming experience, perception, and acceptance of adding game design elements to learning management systems (LMS) in HEIs in Ghana. The findings show that the learner characteristics necessary for technology acceptance encompass demographic features (age, gender), expectations (performance (PE), effort (EE)) and psychological components (social influence (SI), motivation) in Ghana's higher education. The study found that institutional-based trust in

existing technologies is a payoff to accepting new technologies. Prompting the need to re-establish trust in the digital era of accelerated innovation in education. The study further found that after the acceptance of the existing technologies (LMS), students' need to accept GIS is influenced by expected high performance, less effort, attitude, and the existence of social influence. Compared to the UTAUT model, this research found three typologies based on the significant factors in the data analysis that is critical for explaining behavioural intention and technology acceptance. The results from this study proved that two constructs (PE and EE) of the original UTAUT model may be considered as *technology and learner attributes*, while the remaining two (SI and facilitating conditions (FC)) may be considered as *institutional factors* or *outcomes*. A significant omission and less reliance in the conceptualisation of the original UTAUT model is the institutional-based trust (TR) and attitude (ATT). However, these factors produced a substantial improvement in the variance explained in technology acceptance and behavioural intention. Importantly, the extensions (TR and ATT) form the new *psychological safety factors* in the UTAUT model and serve as the necessary conditions for the uptake of information systems in DE. These typologies, hitherto missing in the original UTAUT model, suggested the concept of technology acceptance has gained prominence in HEIs in DE but in the context of technology and learner attributes, institutional factors, and psychological safety factors.

Second, using the SDT, the study examined how game design elements support and enhance students'(n=124) basic psychological needs in learning and the need to clarify the role of autonomy, competence, and relatedness in GIS engagement. This study found three types of learning outcome measures (type of game elements, psychological need, and level of satisfaction) that is critical for a learner to make a decision and engage with the GIS. Importantly, feedback, interactivity and aesthetic appeal were identified as positive elements for maintaining and motivating engagement. The reward systems which include points, badges

and leaderboards were found to be stronger than competition-based elements in motivating learning outcomes. In this regard, competition-based learning on gamified platforms is not a salient practice to enhance students learning outcomes. The study further showed that merely providing students with reward systems does not necessarily lead to user competence, and a higher level of satisfaction is associated with a higher level of learner engagement, thus reducing students' turnover intention. Hence, a diverse and not a one-size-fits-all reward system should be tailored towards the individual learning progress.

Third, to show the feasibility of the GIS approach in education, I applied the MOA framework and developed a model to examine students' continuance use behaviour. To demonstrate the importance of learner characteristics and outcomes of gamification, I conducted an evaluation (n=133) of a gamified version and investigated the efficacy of aesthetic experience, information technology capability, and information quality regarding learner continuance behaviours. The study found the opportunity ability motivation (OAM) framework as the appropriate interplay between learner characteristics, the platform, and the gamification elements. In applying the OAM framework, the findings suggest that for a behaviour change to take place, there is a need for an opportunity to experience it or try it (triability). However, for triability to lead to acceptance or intention to use, there should be ability to perform the behaviour and this ability includes learner characteristics and the ease of cognitive understanding of the GIS. Motivation therefore becomes an outcome because an opportunity has been created to perform the behaviour. The findings also revealed that self-expansion and meaning are the key determinants of aesthetic experience (appeal) of GIS. These new findings suggested that the concept of aesthetic experience, an aspect of both hedonic and utilitarian value has gained prominence in Ghana's higher education. The result of this finding draws scholarly attention to aesthetic experience as a parsimonious yet powerful construct that compliments the notion of continuance use behaviour and engagement with GIS.

The originality and contribution of the study to research and practice are as follows. First, the findings of the three objectives culminate into an *Integrated Theoretical Model of HEI-Gamification Configuration (HEIGC)* for tailoring gamification offerings in HEIs based on three clusters: *Learner characteristics, Learner outcomes (critical decision stage) and Learner continuance behaviour.* The model priorities for policymakers suggest that attitudes about accepting these types of platforms in education is primarily driven by their affordances i.e., psychological safety (autonomy, competence and social influence) and personality traits (PE, EE, Trust, aesthetic appeal and gamification elements) in DE HEIs. Second, this study addresses the limited results and evaluation of gamification and uncovers the efficacy of engaging and motivating learning behaviour change in Ghana and West Africa's higher education. Hitherto absent in literature, this doctoral study addresses the lack of gamification research findings from the DE context. Third, the model provides eight theoretical constructs on acceptance, motivation, engagement, and outcomes of gamification, including a six-step practitioners' guideline for tailoring gamification strategy to motivate HEIs to become more purpose-driven. The contribution of the study has resulted in three peer-reviewed articles, one book chapter and three full conference papers. The candidate has served the Association of Information Systems (AIS) and Gamification Community as the Vice President and Secretary of the Special Interest Group on Game Design and Research (AIS SIGGAME) since November 2019.

DEDICATION

To God be the Glory, Honour, and Praise

Hena na ɔye me yiye sen wo a wodom me daa!- PHB 551 v2

This PhD journey has inspired some beautiful and inspiring quotes. Among the quotes, these are my favourites:

"Research makes you discover a lot of things, and all must draw you closer to God!

Bless souls while they can be reached!

We are not far from struggles, but you have to pick who you want to struggle with on a daily basis!" ***KOA® Quotes***

To my late mother, **Mrs Leticia Owusu Ampong** for the sacrifices, love, and care.

Ultimately, I dedicate this work to the Almighty God

Whom I refer to as 'the I am that I am', the Super Intelligence, my Refuge

The One who's grace is sufficient for my needs – precious grace and grace in fullness

I am thankful for the knowledge and health

Imparted in varying forms

Through life and death

Motivation and demotivation

Sorrow and joy

The heavens declare the glory of God; and the skies proclaim the work of His hands

To Him who showed my mercy, success and protection during the Covid-19 pandemic stay in the heart of New Jersey – Roseville Ave

In fear of Covid-19, the Gracious Lord guided my to publish a review paper from this thesis "the shift to gamification" in remembrance of Him in a foreign land

Ultimately my most cited paper as of dissertation submission

I dedicate this work

To Him and Him alone – The God Almighty.

ACKNOWLEDGEMENT

My ultimate gratitude goes to the Almighty God for the protection, direction, wisdom, tenacity, and diplomacy to undertake my PhD studies. I am truly grateful to Prof. Richard Boateng for the guidance, teaching and mentoring and opening up to me to undertake this PhD work. God bless you, Prof. Boateng for everything you have done for me. To my co-supervisors (Prof. Thomas Anning-Dorson and Dr. Emmanuel Awuni Kolog), I thank you very much for giving me a new direction to research with continuous support and guidance. God richly bless you. To Prof. John Effah, thank you for your advice and encouragement during the coursework part of the PhD program. To my PhD colleagues in Information Systems, OMIS faculty and Mr. Charles Turkson, I say thank you. It has been great exchanging ideas and collaborating with you. I acknowledge the efforts of student participants and lecturers at the Information Technology (College of Education) and Nursing and Midwifery department (2019/2020 academic year) for providing me with valuable information for my research. I could not have published early in this field without your input. God bless you all. Thank you, Dr. Charles A. Adjei for giving me access to the student participants at your department. I appreciate your time and efforts. To my external advisor, Prof. Jane Webster, I acknowledge your immense support in publishing my first article. I appreciate GETFund's generous financial support in this PhD journey. I also thank UNICEF-Ghana/School of Public Health (KES) for recognising and awarding my research contributions to Innovative Initiative for Social and Behavioural Research in Ghana. To UG Business School, I say thank you for the generous travel grant to attend the AMCIS conference which opened many opportunities for my PhD career. To Prof. Divinus Oppong-Tawiah and Dr. Sheena L. Boateng, I am grateful for your "literature" guidance and support. Finally, I would like to thank Mr. Asiedu Ampong (father), my brothers (Oduro-Ampong, Darko Ampong), Wendy, Juliet, the entire family and Hon. Ohemeng-Tinyase (former MP – Kade) for their support. God richly bless you all.

TABLE OF CONTENT

Contents

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

UTAUT .....Unified Theory of Acceptance and Use of Technology
SDT ..... Self-Determination Theory
MOA ..... Motivation Opportunity Ability
IS ..... Information Systems
RO .....Research Objective
GIS ..... Gamified Information Systems
DE .....Developing Economy
AE ..... Continuance Use Aesthetic Experience
AE .....Aesthetic Experience
ITC .....Information Technology Capability
IQ .....Information Quality
HEI .....Higher Education Institution
PBL .....Points, Badges, Leaderboards
LMS .....Learning Management System
HEIGC .....Higher Education Institution Gamification Configuration Framework
GETFund..... Ghana Education Trust Fund
UNI-GAMI .....University of Gamification Systems
UNESCO..... The United Nations Educational, Scientific and Cultural Organisation
UNICEF .....United Nations Children's Emergency Fund
SWOT ..... Strength, Weakness, Opportunities and Threats
Gamification ..... Technology designed intentionally to change attitudes with game elements
Gamification Strategy ... Technique in GIS designed to motivate change in learning behaviour
Behavioural Determinants ..... Factors that influence learning behaviours
Learner Characteristics .....Distinctive attributes of the learner
Learner Outcomes.....Indication of learning accomplishment
Learner Continuance Behaviour .....Prevailing learning environment in existence
Psychological Safety.....Shared belief and safety held by students of the learning technologies and environment
Persuasive Technology (PT).... Intentionally designed technology to change human behaviour

CHAPTER ONE

INTRODUCTION

In recent times, research has demonstrated the potential of technology to enhance positive learning outcomes (Rigby & Ryan, 2011; Rapp, 2022) – help students track their learning behaviour and control their learning and engage in self-discovery of knowledge behaviour (Suh, 2017). With the motivational potential of games, few institutional technologies have started delivering their interventions in game format. These types of technologies that address the lack of motivation, poor student engagement and harness the potential of game design elements have been referred to as *gamification* or *gamified information systems (GIS)* (Sailer & Sailer, 2021). However, extant literature has revealed a dearth of research and theory exists on how gamified interventions motivate behaviours in education, particularly in developing economies. Also, most of the GIS have been evaluated and adopted based on a one-size-fits-all theoretical approach, although learners differ in their acceptance, motivation, engagement, and continuance use of technology. Extant literature has also revealed the lack of an empirical model and clear understanding of the *concept of gamification* in education (Yang, Asaad & Dwivedi, 2017; Yamani, 2021; Yang & Gong, 2021).

The term 'gamification' was initially coined by Nick Pelling and first originated in the digital and online spheres in 2002 but gained popularity in the academic spheres around 2010 (Deterding, Dixon, Khaled, & Nacke, 2011). Due to its infancy, many practitioners and researchers have defined gamification in their own terms, mostly focusing on game design or "game thinking", to address non-entertaining objectives (Zichermann & Cunningham, 2011; Liu, Santhanam & Webster, 2017). However, the most popular and generally accepted definition in human-computer interaction is proposed by Deterding *et al.* (2011), who defined gamification as the use of game design elements in non-game contexts. The definition describes

the importance of *games (playing by rules towards goals)* in gamification and not *play (unstructured activity).* In this instance, the description highlights the use of game design elements as the *means* and the non-game setting as the *application context* and provides the *instrumental goal* to be achieved.

Further, the definition differentiates *games with purpose* or *serious games,* in which a full-fledged game is employed to achieve instrumental goals. Deterding *et al.* (2011) describe the game elements as the design elements mostly found in (but not necessarily all) games, and readily associated with games, and importantly play a significant role in gameplay. Game elements purposely designed to include utilitarian value (productivity) and hedonic value (fun, excitement) is termed gamified information systems (GIS) (Koivisto & Hamari, 2019).

Over the past decade, many organisations and higher education institutions (HEI) are adopting gaming strategies and game elements techniques to increase engagement (Gartner, 2011; Parra-González *et al.*, 2021). Despite the importance of gamification, there remains a paucity of evidence (anecdotal) and academic rigour in current gamification literature (Yang, Asaad & Dwivedi, 2017). Because the concept of gamification is relatively new, conceptualising gamification and ascertaining whether gamification measures up to the positive predictions about its value and effectiveness have been rarely provided in various gamification research (Sailer *et al.*, 2017). In other words, how institutions realise the effectiveness of gamification design is largely unclear, mainly in the context and purpose of deploying gamification. Subhash and Cudney (2018) posit that the expectation of success in deploying gamification in HEI is often unrealistic. Accordingly, many HEIs fail to conduct an extensive examination to know whether gamification is the right teaching and learning platform for their educators and students before implementing it (Burke, 2013).

Importantly, in the field of information systems (IS), there is an increasing prevalence that interventions to change behaviours should be informed by theories of behaviour change (Michie *et al.*, 2008; Siponen & Baskerville, 2018). Previous studies have proposed a strategy for evaluating interventions to suit a context, which begins with a theory stage before advancing to modelling and then exploratory trial (experimental stage) (Campbell et al., 2007; Al-Mamary et al., 2019). The process of developing and implementing gamification especially in HEI in developing economies is seen as challenging. The problem arises in the evaluation of gamification because researchers in DE have not fully defined, identified, and developed the gamification intervention in teaching and learning in HEIs. This study, therefore, advocate for the use of theory in developing and evaluating gamified interventions. The reason for advocating a theory-driven behaviour change in gamification is that the intervention is likely to be more effective if the evaluation is theoretical informed and the causal determinants are well understood and explored. Thus, a theory-driven gamified intervention provides a clear understanding of what works in DE and facilitates the development of better theory across different economies and contexts (Michie *et al.*, 2008). Therefore, this research used behavioural theories to investigate how gamification can motivate and engage interactive learning behaviour in Ghana.

1.1 RESEARCH PROBLEM

The research problem to be addressed in this thesis is that: *the low adoption rate of most existing (gamified) information systems takes a one-size-fits-all adoption approach in developing economies, rather than tailoring gamification to the target audience (learner) level of acceptance, motivation (engagement) and continuance intention to use.* Research has shown that considering users as a homogeneous group in a gamified learning environment is a poor evaluation technique (Nkwo & Orji, 2018, Nah *et al.*, 2019) and therefore has pointed out the limitation and unintended consequences of gamification, especially those designed to motivate

and engage learning behaviours. The following paragraphs highlight the research problems for this thesis.

Despite gamification hype and widespread demonstration of its effectiveness in motivating behaviour change, evaluation of gamification successes has also been associated with negative results and unexpected failures (Nah *et al.*, 2019). For example, inconsistent evidence was found about the impact of gamification on user engagement (Lee & Yang, 2011) as a result of using ineffective gamification strategies. The effectiveness of gamification strategies in a target system for promoting enhanced learning varies for various user personality types and contexts of learning. Likewise, I reviewed the literature and examined the influence of adoption of behavioural determinants and gamification strategies on learners, and found that certain determinants (e.g. classroom environment, trust and facilitating conditions) and strategies inhibit the acceptance of educational technologies for changing behaviours.

To address such concerns, gamification research has embraced several theoretical frameworks that explore gamification's potential in restructuring task activities (de la Peña Esteban, Torralbo, Casas., & García, 2020). However, the process of designing, developing, and evaluating gamification intervention is a challenge. The problem is more evident in DE where researchers have not fully defined, identified, developed and evaluated the complex gamified intervention in higher education in terms of adoption, engagement and usage. Thus, the field of gamification lacks an integrated theory for developing gamified interventions in HEIs.

The Self-Determination Theory (SDT) by Deci and Ryan (1985) is a dominant theory used to understand game motivation, either by intrinsic or extrinsic motivation. SDT assumes that humans have innate tendencies towards psychological growth – a unified self, autonomous and responsible behaviour. A recent study by van Roy and Zaman (2019) represents success in applying SDT in unravelling gamification potential in education. However, the

interrelationship between game elements needs satisfaction, intrinsic motivation, and gamification outcomes were not explored in the study by van Roy and Zaman. Further, the scholars precisely reported the ambivalent motivational power of gamification but the mediating role of the psychological need satisfaction between game design elements and learning outcomes was not reported. To conclude on SDT tenability, van Roy and Zaman's (2019) study results show insufficient and limited. Hence, more research is needed to validate SDT in tailoring gamification in education.

Moreover, empirical research on motivational information systems has started to mature by investigating information systems continuance use and its relationship with aesthetic experience (Suh, 2017; Jahn *et al.*, 2021), user satisfaction, information technology capability (Panda & Rath, 2021) and information quality (Wixom & Todd, 2005; Afful-Dadzie *et al.*, 2021). However, available literature shows that these dimensions have often been overlooked in gamification research, i.e., limited research exists in investigating the relationship between aesthetic experience, information technology capability, and information quality and the effect on students learning behavioural outcomes in higher education (Suh *et al.*, 2017). Motivational affordances are the fundamental properties of the IS that determines how it can support one's motivational needs (Deterding, 2011); information quality is the system output the IS produces (DeLone & McLean, 1992); user satisfaction is the perceived use of IS as enjoyable; information technology capability is the individual competence and capabilities for navigating and managing an IS (Fink & Neumann, 2007). Thus, researchers in gamification have not looked at the true nature of enhancing user engagement through gamification. Thereby, little attention has been paid to whether users have a satisfying experience. Hence, the consequence of understudying user satisfaction in gamified learning may include motivational affordances - aesthetic, quality of information and information technology capability, which ultimately reduce meaningful engagement (Liu *et al.*, 2017).

Moreover, the MOA framework has been extensively applied in organisational behaviour research, unlike persuasive technology (PT) research. The lack of literature research may be due to the unresolved relationship among MOA factors in the gamification context and operationalisation challenges (motivation, opportunity and ability). While gamification is an infant research area, motivation has been valued as a critical factor in predicting the continuance use of gamified IS. However, the effect of opportunity and ability are inconsistent in IS literature across gamification research (Nicholson, 2012; Xu, 2011). Thereby placing the MOA framework in the gamification context addresses the effect of these factors.

Further, the three dimensions of the MOA framework – motivation, opportunity and ability – have been overlooked in gamification studies (Holzer *et al*., Gillet, 2020). They have been studied as individual constructs, although existing literature shows that the lack of any of the factors would cause a bottleneck in gamification application and that a change to the MOA factors can influence the direction of MOA elements in a proposed framework (Kettinger *et al*., 2015). Thus, the HEI provides an external learning platform service to motivate a learner in a congruent way with the instructors' goal and not solely act on the individual self-interest (Kang & Kim, 2017). To this end, the instructor provides the opportunity and ability for the learners to deliver their learning goals. Consequently, new insight can be gained from an individual-learner perspective if studied together. Therefore, exploring the gamification elements on MOA factors is essential, as mediated by aesthetic experience and information technology capability. Furthermore, after reviewing these important pieces of literature about technology adoption, self-determination (engagement) and continuance use of GIS, it can be realized that no scholar has yet connected all aspects of the three dimensions from the original relationship between the learner and the GIS to find a broader justification for including in HEI teaching and learning strategy.

In summary, this thesis seeks to address the following identified research gaps: a) studies on gamification have primarily been from the developed economy perspective (Suh, Wagner & Liu 2018; Koivisto & Hamari, 2019). Researchers in this context have applied gamification to various disciplines and mostly from economies like Finland, South Korea, United States and Canada. From the DE context, there is relatively less demonstration of gamification research and gameful experiences in education and the available literature remain relatively silent on the emergence of gamification in education (Adukaite *et al*., 2017; Rahi & Abd. Ghani, 2019). Accordingly, this study offers an opportunity to understand how gamification is applied in higher education where comparably gamification research and usage is just at its nascent stages in developing economies (Adukaite *et al*, 2017). b) The second research problem to be addressed is validating the self-determination theory in a gamified learning context. As previously stated, the works of van Roy and Zaman (2019) represent success in the application of SDT in unravelling the gamification potential in education. However, the interrelationship between needs satisfaction, intrinsic motivation, and gamification outcomes were not explored in their study. c) Lastly, this study responded to Liu *et al*. (2017) and Zainuddin *et al*. (2020) call for researchers to consider using other motivational theories rather than the default cognitive evaluation theory and flow theory commonly used in the literature.

Finally, due to the lack of gamification guidelines, there is increased acceptance of specific gamified information systems (e.g. Kahoot) without consideration of the appropriate game design elements for the target audience. The lack of readily available gamification guidelines for tailoring learning experiences in higher education in DE for students has led to instructors adopting GIS with a one-size-fits-all approach and intuition. Understanding the students and the appropriate game design elements that would enhance their learning require time, money and experience. The instructors and designers may not have the resources needed to understand

and develop guidelines for the target behaviours before and after the implementation of gamification.

1.2 RESEARCH PURPOSE

The purpose of this research is to develop a theoretical and practical-oriented framework for tailoring gamification to a target audience in higher education.

1.3 RESEARCH OBJECTIVES

This study draws on the unified theory of acceptance and use of technology (Venkatesh *et al*., 2003), self-determination theory (Deci & Ryan, 1985) and the motivation-opportunity-ability framework (Maclnnis & Jaworski, 1989) to examine the value of tailoring gamification to students. To achieve the purpose, the following research objectives (RO) were identified:

RO1: Defining and exploring gamification

1. *To explore students' gaming experience, perception and acceptance of adding game design elements in higher education institutions in a developing economy context (evidence from Ghana).*

RO2: Learner engagement and motivation with gamified information systems in education

2. *To determine how gamification supports higher education students' basic psychological needs (aligning with the self-determination theory).*

These objectives respond to the call for future studies to explore the progressive development of gamification in education institutions (Liu *et al*., 2017). Based on literature review on gamification, the objectives rely on the UTAUT and the SDT to distil the key factors and contingencies that relate to the prediction of behavioural intention to use technology. The objectives also seek to explain the behavioural motivation behind the interaction with digital

technologies. The behavioural motivation underlying the use of gamification can be understood from three psychological need perspectives: autonomy, competence and relatedness (see Chapter five).

RO3: Continuance use of gamified information systems in education

3. *To determine how learner's aesthetic experience (motivation), information technology capabilities (abilities), and information quality (opportunity) contribute to continuance use of gamification in education (aligning with the MOA theoretical perspective).*

To address the need for an integrated model that explains the need to tailor gamification to the target audience, this objective responds to Suh *et al.*'s (2017) call. Specifically, this research presents a more comprehensive view of what underlies the learner's continual use behaviour with digital technologies. The objective relies on the MOA framework to understand the individual learning process in a gamified platform and specify the components that drive learners to a desired outcome. Even though different factors have been explored, few studies have attempted to pull them together in a single explanatory model. This objective fills the gap by integrating the factors in a single model to improve our understanding of tailoring gamification. This framework suggests that continuance use is driven by three primary factors – motivation to use, opportunity to use and ability to use.

1.4 RESEARCH QUESTIONS

The following research questions (RQ) are formulated to guide the process to achieve this thesis's objectives.

RQ1: What are students' gaming experiences, perceptions and acceptance of adding game design elements to learning in higher education institutions in Ghana?

RQ2: How can gamification motivate and engage students in their basic psychological needs in a technology-enhanced learning environment?

RQ3: Do learners' aesthetic experience (motivation), information technology capabilities (abilities), and information quality (opportunity) contribute to continuance use of gamification?

1.5 SIGNIFICANCE AND CONTRIBUTION TO KNOWLEDGE

As gamification becomes a popular technique, research is needed to investigate its validity as an organisational learning strategy. This thesis contributes to advancing the field of gamified information systems and the development of interactive systems for enhancing learning performance. The thesis not only demonstrated the need to explore the behavioural determinants through extensive conceptual models and large-scale data, but it also established the need to tailor gamification to the target audience to increase engagement and motivation. Specifically, the thesis made three main contributions to the field of gamification in higher education

First, to demonstrate the applicability of gamification approach in education, I developed three main conceptual models for tailoring gamification based on learner acceptance, engagement and continuance intention to use. I further conducted a large-scale study (N=185, N=124, N=133) that examined the determinants of gamification for students from different education levels but same university, of both genders, of different ages and from a developing economy context. Based on these results from the studies, I developed a decision table for quantitative inferences and meta-deduction inferences to deconstruct a meaningful and engaging integrated framework for higher education.

Second, based on the findings of the studies and the need to make the results actionable for instructors and designers in higher education, I mapped the significant determinants of the three studies to develop an *integrated model for gamification configuration* – Chapter 8. Having an integrated model for gamification strategy that motivates students learning performance provides an important methodological bridge between instructors and gamification researchers.

Finally, to bridge the gap between instructors, practitioners, and designers of gamification in education, I proposed an appropriate guideline for tailoring gamification in higher education in developing economies. The practitioner-driven guideline provides an immediate actionable blueprint for designers to build an effective gamified information system for engaging and motivating learning behaviour change. In terms of policy, the study provides directions to higher education institutions on policies to effectively integrate gamification in existing learning management systems rather than developing GIS from scratch. The next section focused on the breakdown of the chapters.

1.6 THESIS STRUCTURE

The dissertation presents eight chapters. *Chapter One* comprises the introduction of the study, research problem, the research purpose and objectives of the study. It also contains the research questions, significance and contribution of the study, and the structure of the study.

Chapter Two contains the conceptualisation of gamification to address the definitions underlying the discipline as a study. It includes the methodology for review of gamification articles in this dissertation and presents the dominant game design elements used to motivate and engage users.

Chapter Three presents a deconstruction of gamification to emphasise the transformation in higher education and provides a survey of evidence of the acceptance and behavioural change in education.

Chapter Four presents the theoretical concepts underlying this study. Specifically, this chapter reviews the three theories underlying this study (UTAUT, SDT and MOA). The chapter also presents the research framework and hypothesises of the behavioural determinants.

Following the identified theories and development of the thesis hypothesis, *Chapter Five* presents the research methodology, which contains the research paradigm guiding the study. It includes a selection of the study area, the gamification platform and summary of the research strategy for the research objectives.

Chapter Six analyses the data from the quantitative and follow-up study on acceptance, engagement and continuance use of gamified information systems. The analysis is aimed at investigating the effectiveness of the proposed theory-driven gamification research framework by examining whether gamification elements promote engagement and continuance use of persuasive technologies in teaching and learning.

Chapter Seven summarises the main findings from the study results and discusses key issues underlying gamified information systems deployed in a developing economy context for behavioural change and motivation in education.

Chapter Eight briefly summarises the work contained in this dissertation, recaps reflections on theories, conceptual framework, methodology, contributions, and limitations and outlines the future direction for gamification research in developing economies. Based on the reflections on theories and results of quantitative inferences and meta-deduction presented in this dissertation, a post-study theoretical framework and an integrated model was proposed for future research.

CHAPTER TWO

GAMIFICATION AND CONCEPTUALISATION

2. CHAPTER OVERVIEW

The previous chapter introduced the research background, objective, problem, significance, and contribution to knowledge. This chapter focused on defining and conceptualising gamification to address the issues with definition and emphasize the decision choices based on gamification and quantitative method outcomes. Importantly, the chapter provides the methodological approach that this thesis followed for reviewing articles. The chapter also highlights the relevant gaps and approaches underlining gamification research design.

2.1 FRAMING GAMIFICATION RESEARCH

In workplaces and schools, there is a history of institutions leveraging games (Hanus *et al*., 2015) and competitions. With innovations in digital platforms, the concept of gamification has sprung as a new field of study with some reproof. Despite criticism of the word and its phenomenon gamification has stuck (Werbach, 2014). Appropriately, gamification is to intentionally transform activities and engage users to the desired outcome. By way of adoption and interest in education, it has witnessed significant growth. Notwithstanding, critics argue that gamification is exploitative, and the question of the uniqueness and value of gamification still remains, and more research is needed (Leclercq, Poncin & Hammedi, 2017).

The interest of this study is to better understand gamification research in Ghana. Since there is no agreed definition for the term gamification, the long-established definition applied is the use of game design in a non-game context. The generalization of what constitutes game elements is not known to gamification, making gamification research problematic. In appreciating the value of gamification, some scholars view it as a process of making activities more game-like.

The appropriateness of this definition is that it incorporates both practitioners and academic viewpoints and bridges the persuasive gap design in gamification.

On the other hand, gamification fosters problem-solving and promotes desired behaviours in two ways. The game components such as leaderboards, badges, point systems, and levels that translate inputs to outputs are called *game mechanics*. While the game elements (achievements, competition, rewards, and self-expression) that regulate interactions among players with game mechanics are *game dynamics*. The definitions are categorised in Table 2.1 and conceptualised to identify gamification as either a design element (Deterding *et al*., 2011; Werbach & Huotari, 2012; Zichermann & Cunningham, 2011), process technique (Werbach, 2014; Fitz-Walter, 2015) or as a service package (Huotari & Hamari, 2012).

Given Deterding *et al.'s* (2011) definition of gamification and the aim to explore gamification in education, the term has been conceptualised as the application of game elements to execute functions of business in dealing with internal and external stakeholders' motivation to solve problems and promote the desired learning behaviours.

Table 2.1 Some definitions of Gamification

Author(s)	Definition/conceptualisation
Huotari & Hamari (2012)	"A form of service packaging where a core service is enhanced by a rules-based service system that provides feedback and interaction mechanisms to the user to facilitate and support the users' overall value creation".
Deterding *et al*. (2011)	"The use of game design elements in non-game contexts (p.5)."
Werbach & Hunter (2012)	The use of game elements and game design techniques in non-game contexts.
Werbach (2014)	The process of making activities more game-like.
Fitz-Walter (2015)	"A design strategy where game elements are used in non-game applications to promote behaviour change and enhance the hedonistic qualities of the user experience".
Zichermann & Cunningham (2011)	The process of game-thinking and game mechanics to engage users and solve problems.

The definitions stated in Table 2.1 seem to suggest gamification is easy to implement. However, the definitions suggest that gamification requires more game thinking and game mechanics to be successful. Hence, it is easy to fail in implementation, especially in an educational context. According to Fitz-Walker (2015), the main reason for the failure of most gamification projects in an educational context is the lack of game thinking. This approach mandates designers to rethink the teaching curriculum and practices. Thus, game elements should be integrated with activities when there is a clear understanding of how gamification works for the target audience. Gamification is not just developing a game that imparts a lesson; rather it is applying game thinking to how we impart that lesson and develop it based on the feedback from the players (Folmar, 2015).

It should be noted that GIS is not the only innovation tailored towards user motivation and behavioural change in a non-game context. Instead, GIS indicates a component of persuasive technologies. Persuasive technologies represent a broader concept that describes technologies that attempt to reinforce and shape behaviours, promote knowledge sharing (Wiafe *et al*., 2020) and foster the use of game design elements. In this regard, Fogg (2003) defined ***Persuasive Technology*** as *a device or computing system designed intentionally to change an individual's behaviour in a predetermined way without using deception or coercion.*

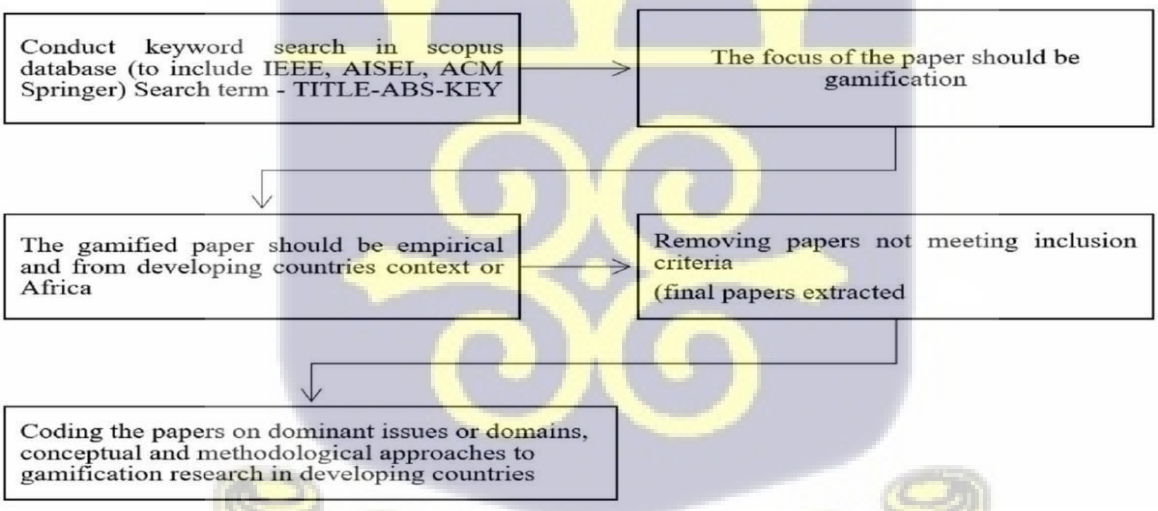
2.2 METHODOLOGY FOR GAMIFICATION REVIEW

The need to situate this study in an education context led to the review of relevant and current materials. The purpose of the review is to better understand gamification in all spheres and organise the literature around gamification in education. Most of the insights in this Chapter and the next spun from this methodological approach. The process for the review is as follows. First, a search for the review materials was conducted in the Scopus database. Scopus was preferred because it indexes all the potentially relevant databases such as Springer, IEEE, ACM

and AISel (Pare et al., 2015). Second, the search terms used in the database were: TITLE-ABS-KEY (gamification education, gamif*, gamification in Africa, gamification in developing economies). Figure 3 shows the process involved in selecting the papers for the review. The year for the search ranged from 2010 to January 2020. This is because the concept of gamification commenced in 2008, however, it gained popularity in the academic environment in 2010.

Inclusion and Exclusion Criteria: As shown in Figure 1, the initial search resulted in 1,978 hits. Further screening was done to ascertain useful results. The abstract, keywords and full text were screened for relevance, and duplicate articles were deleted. Based on the search descriptors, the retrieved papers were classified according to the domain of study and publication type. The overall process resulted in 101 reviews as full and empirical research papers.

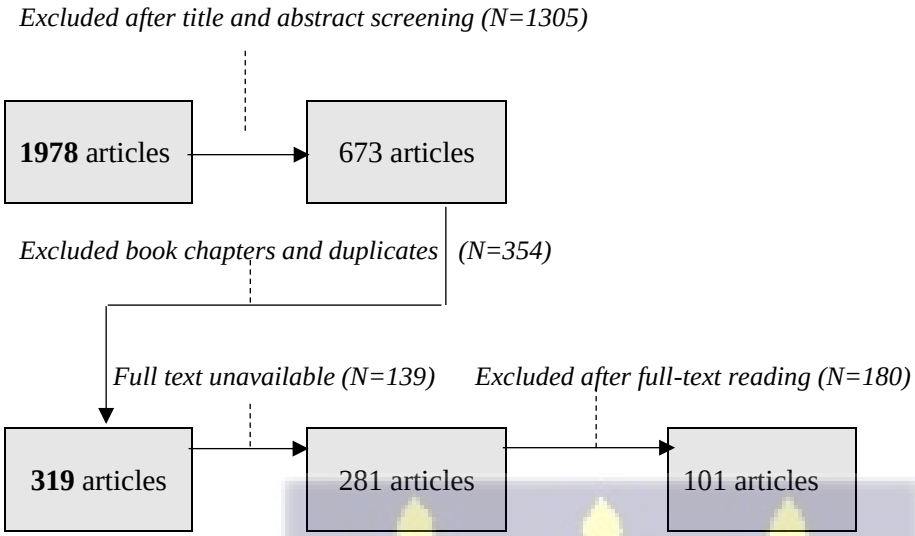
Figure 1. Process Involved in Selecting the Papers



Empirical papers met the following condition 1. Evidence of data collected 2. Reporting on data gathered 3. Analysis and results of the data obtained. To gain much insight into gamification in education, the researcher first runs an analysis to ascertain the *a) dominant issues in gamification research in developing economies b) dominant conceptual approaches – research frameworks in gamification research c) dominant domains in gamification research*

and d) methodological approaches to the gamification study. The analysis of these results can be found in Appendix I (Table 1-4).

Figure 2. Screening Process in a Flow Diagram



2.3 DOMINANT GAME DESIGN ELEMENTS

Five dominant game design elements used in education and learning were identified in the literature review in the developing economy context. The game elements include:

2.3.1 Levels

The game level is a section of a game that players complete to move to the next stage. Games have different levels that give the players a sense of progression or movement. One level requires less effort to move toward the end of the game. At the same time, the other requires more experience, effort, and skills – degree of difficulty. Players gain more experience as they progress through the game. However, students learning abilities may not progress as a result of levelling, even though levelling serves as a form of reward or incentive (Goldhill & Roodt, 2018) to the learner for completing assignments or quizzes.

2.3.2 Points

The point system is recognised as a measure of how well a learner has performed or achieved. The points come in the form of rewards or feedback for further progress towards the assignment. For example, points (experience) provide immediate feedback for learners to correct errors and indicate their current standing and progress. The literature reviewed revealed that feedback influences learners' answers, activities, and behaviour. Hence, points must be designed to provide feedback and act as a roadmap for making the right decisions.

2.3.3 Badges

Badges functions as a mark of accomplishment, social relevance, mastery, or achievement that can be displayed for colleagues to see – a digital symbol, medallion, or stamp. The use of badges helps maintain learners' motivation and engage them in future learning tasks. To preserve the value of badges, it must have a social relevance – thus, must be valued by the learner who earned them and the group or community of learners.

2.3.4 Leaderboards

An effective way to create a competitive environment among learners is the use of leaderboards – ranking per the highest score or points. The objective of a leaderboard is to keep the learners motivated and not demotivated, as it tends to demotivate the last 10 members in a group and motivate the first 10 in a group. *Advice:* Instructors or designers should only display the top 5 or 10 achievers to avoid demotivating other students. This motivates other players to compete for the top spot or scorers by closing the point gaps. An example of top five (5) players on a Kahoot leaderboard is displayed in Figure 3 - **Player 10622901** leading the board. *Kahoot!* is a game-based learning application with an average of 50 million active users.[1]

[1] *"Kahoot! is used as an educational technology in schools and other educational institutions. Its learning games, "kahoots", are user-generated multiple-choice quizzes that can be accessed via a web browser or the Kahoot app."* https://kahoot.com/schools-u/

2.3.5 Storyline

Several researchers have utilised a storyline to gamify education and help learners stay motivated throughout the learning process. Storyline refers to the story in the game or narrative.

Figure 3. Display of Players on a Kahoot Leaderboard

Exposition: From the discussion of the five-game design elements, gamification primarily attempts to provide users with feedback. The feedback provided by gamification includes affective, cognitive and social (see Appendix I, Table 2 for review). Affective feedback is central to the affordances that the game presents, such as the type of game design elements to use to arouse excitement, enjoyment, and interest. Cognitively, gamification thrives on individual behaviours rather than organisational activities. Consequently, game design elements can be seen as a decision support system that provides cognitive and instrumental data about the learners' activities. Finally, gamification affords users social comparison with interactive classroom goals that strengthen learning environments and create a sense of social belonging and community.

2.4 GAMIFICATION RESEARCH: CONCEPTUAL APPROACHES

Educational technology behaviour theories support understanding of educational behaviour problems. These theories also help in developing educational systems and interventions based on predominant determinants that affect behaviours and examine the acceptance and

effectiveness of such programs. Highly adopted and accepted behaviour change systems usually occur when the system is behaviourally theory-driven (Consolvo *et al*., 2009). Therefore, gamified systems can be made optimally accepted, if informed by adoption and behavioural theories. Using adoption and behavioural models increases usability and acceptance of the intervention in realizing the desired goal (Granić & Marangunić, 2019). In this regard, theory helps researchers move beyond conceptualization to evaluating education behaviour interventions.

Several theories and research have sprung on human behaviour and what motivates individuals to change their behaviours (Deci & Ryan, 2012). These theories address education behaviour and have informed recent gamified education systems, for example, the Technology Acceptance Model, Theory of Planned Behaviour and UTAUT (Yang *et al*., 2017). The most dominant and recently applied education technology theory is the UTAUT, shown in Table 2.2. This theory is explained in detail in Chapter 4, however, it remains one of the most widely used theories in technology adoption behaviour and focused on why people reject or accept educational measures. From a classical educational perspective, it explains how and why the existing education system has evolved.

Decades of research on motivation and engagement have also resulted in many theories on human behaviour which includes self-determination and motivation opportunity ability theory. The most recent theory that has informed gamification design and evaluation is SDT (Deci & Ryan, 2012). The SDT explains human motivation in a social context that differentiates motivation in terms of controlled or autonomous (freewill) behaviour. However, the MOA theory remains one of the few employed theories of human behaviour which postulates that, for any occurrence or non-occurrence of behaviour, the learner is affected by the characteristics and the external environment (Maclnnis *et al*., 1991), as shown in Table 2.2. The SDT and MOA theory is explained further in Chapter 4

Table 2.2 Results of studies on gamification underpinning the research objectives

Research study	Research Focus and technology context	Characteristics	Underpinning theory and framework	Relevant gaps for future research
Theories from Technology Acceptance				
Baptista & Oliviera (2017) Yang, Asaad & Dwivedi, 2017 Fitz-Walter (2015)	Identifying the potential impact of game design techniques in the acceptance of mobile services ***Acceptance***	Learner characteristics Personal traits Background Facilitating conditions Social influence Learner attributes Gender	Unified Theory of Acceptance and Use of Technology (UTAUT2) *The development phase of gamification acceptance* *Quantitative research method*	Proposes general demographic, behavioural or technology-related factors. No specific factors related to gamification in the education context. Need to introduce new constructs such as institutional-based trust or risk in progressing the user acceptance model in predicting user attitudes Need to understand what works in a particular context and plan for the appropriate user interactions (culture can influence the game techniques and hedonic way of applying) • *Need to re-examine the over-reliance on technology acceptance models constructs and introduce new*
Samar & Mazuri (2019) Rahi & Ghani (2019)	Examining how game design elements influence the user's intention to recommend a mobile app to others	Motivators and drivers of technology acceptance	Unified Theory of Acceptance and Use of Technology *Quantitative research method*	Need for an integrated model that combines UTAUT constructs and self-confidence Routinisation of technology influence by individual antecedents – however specific factors related to e-learning gamification intentions not studied
Theories from motivation				
van Roy & Zaman (2018) Vanduhe, Nat & Hasan (2020) Jeno *et al*. (2019)	Probing students' experiences with game design elements ***Motivation/ Engagement***	Type of game elements Task or assignment characteristics Challenges or competition Rewards systems	Self-Determination Theory *(See 2.3.2 gamification and motivation)* *Qualitative mixed method*	Need to explore the precise nature of how individual satisfaction develops following the application of different gamification elements in learning activities Need to scrutinise the impact of potential feedback on timing. Need to explore other developing contexts to address generalisability

Suh, Wagner & Liu (2018) Wiggins (2016)	Examining how game design elements enhance user engagement	Autonomy, competence, Social relatedness (SDT) Self-growth Discussion/ task variety	Cognitive Evaluation Theory (CET) *Quantitative research method*	Need to investigate the effect of different competition structures on competence in a gamification context. Need to detail guidelines for tailoring gamification in education No specific determinants of continuance use of gamification in education • *Huge potential to maximise the impact of gamification in various learning platforms*
Framework-based approaches				
Schobel & Sollner (2016) Hamari *et al*. (2020)	Gamifying information systems—adapting gamification to individual preferences ***Continuance intention to use***	Aesthetic experience Self-efficacy, capabilities Opportunity Information quality System quality Self-meaning Task to students Expectation Disruptions	Four- different specifications for each of the nine-gamification elements Motivation Affordance (opportunity and ability to use) – Psychological – Behavioural outcomes *Quantitative research method*	Need to consider learner preferences, motivational structures and cooperative dynamics of system users. Need for a long-term analysis of game design elements from an adaptive and non-adaptive observation to develop motivation for use and actual use of gamified information system. No integrated theoretical framework in IS to address the adoption, motivation and hedonic value of gamified systems
Integrated framework				
Yamani (2021) Holzer *et al.* (2020)	Conceptual framework to integrate gamification in e-learning	Trust Learner outcomes Immediate feedback Perceived usefulness Platform architecture System evaluation	Proposed a conceptual framework based on an instructional design model but failed to incorporate the level of acceptance and post-acceptance behaviours characterising gamified e-learning	There is a necessity to develop an integrated theoretical framework that ensures acceptance, motivation and engagement and continuance use (post-adoption/acceptance behaviours) of gamified information systems, especially in HEI developing economies. •*To avoid the risk of demotivating users with gamification*

Source: Author

The process of implementing a gamified intervention in higher education can be challenging because researchers have not taken a keen interest in fully defining and developing the intervention in gamification. This is the motivation behind the researchers' interest to provide a theoretical framework for developing and designing gamification interventions necessary to change behaviour in HEIs in developing economies. The main reason for promoting the use of theory in implementing gamification is that such interventions are more likely to be adopted and effective if the theoretical mechanism of the change and the causal determinants of behaviour are targeted and understood (Michie et al., 2008). Importantly, a theory-driven gamified intervention enables an understanding of what works best and serves as a basis for developing a theory that suits the developing economy context, higher education, and different behaviours. Also, since theory can be developed and tested when the gamified intervention is theoretically informed, it helps facilitate evaluations and measures of effectiveness for outcome improvement. In conclusion, the review on behavioural theories reveals UTAUT, SDT and MOA as relevant single theories that can influence the target behaviour in HEIs in DE. These theories answer each of the proposed research questions and are applicable in determining the identified behaviours of the target audience. The result of this study is to provide a detailed guideline for tailoring gamification in education from the DE perspective; since there is no known integrated theoretical framework in IS that has addressed the adoption, motivation, continued use and hedonic value of gamified systems. The following section presents the approaches to gamification research design.

2.4.1 Approaches to Gamification Research Design

The conceptualisation of literature on gamification falls within the early adopters of the dominant research design. Since gamification is a new research area in DE, the objective of the review on research design is to generalise from a sample to a population to make inferences about some characteristics or behaviour exhibited in GIS. The review showed the dominance

of deductive quantitative approach (Nelson, Todd & Wixom, 2005). The preferred survey was cross-sectional with self-administered questionnaires – data collected at one point in time, compared to the longitudinal data collected over time. The choice of the research model and quantitative reasoning of this study was informed by this review. As shown in Table 2.3 is an elaboration of gamification decision choices on quantitative design. Based on the applicable gamification elements, the quantitative method outcomes revealed both the intended and unintended outcomes of gamification in addressing behaviours. In this regard, Table 2.3 indicates how the researcher followed the established criteria for a quantitative design in unravelling the potential of gamification in a DE context.

Table 2.3 Decision Choices based on Gamification and Quantitative Method Outcomes

Gamification elements	**Quantitative method outcomes**	**Decision and reference to study objectives in developing context**	**Reference**
Points, Levels, Leaderboards, Progress bar, Feedback, Chat Badges, Avatar, Storyline	Positive attitudes, Engagement, Determinants of adoption and acceptance, Motivation, Interest *Research question*	Decision on research method: Quantitative method is adequate to address the determinants of adoption in Ghana. Identify potential research questions: • The candidate wrote the quantitative research questions first • Quantitative questions include "what are adoption theories?" and "which of them can address the issue of gamification in education?" • Other question was "what are the determinants and salient factors of gamification adoption, motivation and continued use?" • There was a predetermined relationship between the research question and the research process	Denden *et al.* (2017) Darwish, 2017
Stages, Levels, Scoring, Badge, Results	An improved students' performance, motivation		Khalee *et al.* (2019)
Progress bar, Challenger goals, Badge, Notifications	Awareness creation, Interaction		Brehil *et al.* (2017)
Points, Badges, Leaderboards, Progress bar, Performance graphs, Avatars	Engagement *Purpose of quantitative method research*		Ezezika *et al.* (2018) Ismail *et al.* (2018)
Leaderboard, Scoresheet, Points	Motivation	Decision on strategies to collect data and analyse quantitatively • Largely, quantitative study from similar population. Thus, the quantitative and qualitative research approaches were not equally important in dominance and application to gamification research • Exploratory investigation and design • Closed-ended questions was adopted • In conclusion, the most dominant research approaches are design and sample design strategies, data collection and analysis strategies and theoretical reasoning	Goldhill & Roodt (2018) Mikka-Muntuumo *et al.* (2018)
Badges, Points, Level, Narrative, Storyline Leaderboards, Virtual Rewards	Motivation, Preventing victimisation *Purpose of the study*		
Leaderboard, Badges, Badges counter, Quiz, Points, Teams, Feedback	Motivation, Engagement, Attitude, Knowledge, Stimulation		Haruna *et al.* (2018) Mloza-Banda *et al.* (2017)
Points, Leaderboard, Badges, Story Lines, Competition, Missions, Loop, Challenges, Levels	Achievement, Attitudinal change in wanting to learn new things *Theoretical reasoning*		

Virtual rewards	Increased perceived competence,	Decision on developing and testing hypothesis to make a prediction Quantitative inference: reliability, and internal and statistical conclusion of validity	Katule *et al.* (2016)
Compulsory badges, Challenge badges	Interest in implementing and integrating technology to support teaching and learning, Enthusiasm		Botha and Herselman (2017)

Source: Author

In summary, the decision choice based on gamification and quantitative method outcomes revealed three main decision contexts a) Decision on research method b) Decision on strategies to collect data and analyse quantitatively and c) Decision on developing and testing hypothesis to make a prediction. These decisions inform this study on how gamification can be tailored to meet an individual or target audience in achieving the intended learning behavioural change in HEIs in DE.

2.5 CHAPTER SUMMARY

The chapter explored the definition of gamification and conceptual approaches in game elements implementation. Several important gaps were identified and the need to explore the interrelationship between game design elements and other constructs like intrinsic motivation and gamification outcomes and trust was established. Also, the need to examine how game design elements support and enhance students' basic psychological needs in learning and the need to clarify the individual roles of autonomy, competence, and relatedness in continuous learning behaviour. The chapter concludes with the decision choice based on gamification and quantitative method outcomes. The next chapter further the discussion on gamification in developing economies, specifically in education.

CHAPTER THREE

GAMIFIED LEARNING: SURVEY OF EVIDENCE IN EDUCATION

3.1 OVERVIEW

In Chapter 2, I framed gamification and highlighted key definitions that are relevant to this study. The chapter also discussed conceptual approaches and identified decision choices for analysing gamification based on quantitative methods. In this chapter, I examine the applicability of the GIS approach for enhancing teaching and learning from existing literature and identify research gaps for future gamification research.

3.2 DECONSTRUCTING GAMIFIED SYSTEMS IN HEIs

The field of games in education has matured in recent years, and educational institutions in DE are exploring the growing trend of tailoring games. Research has shown that games, when applied effectively, can affect behaviour change to the desired outcome (Deterding *et al*., 2011). Gamification has been applied in many domains, including health, education, political campaigns, marketing and sustainability. In the education domain, gamification can be categorized into two main areas: transformation in higher education and survey of evidence on gamification in education. In the following subsection, I present a review of gamification in each section with a deconstructed explication of the determinants addressed in the RO (*see* Appendix I & II for extended Analysis of Literature Review on Gamification, pg. 225).

3.2.1 Transformation in Higher Education

Transformation may be difficult for everyone, and for students and instructors in HEI it is becoming obvious that transformation is constant (Pearce & Wood, 2019). Lessons from the Covid-19 pandemic in early 2020 reveal that transformation is synonymous to change as the education sector was not spared the brunt of the virus. There was a huge transformation in teaching methods and resource allocation to enable school business continuation, frustrating

both instructors and learners. Education transformation expert Michael Fullan (2014) who has studied schools in the last forty years asserts that the introduction of technology solutions in schools is reported with mixed results and success. The review of literature reveals that two main factors affect the implementation of innovation in HEIs (Ketelhut & Schifter, 2011). These include:

a) the characteristics of the transformation (e.g. the need to transform, the complexity and levels of the transformation, the practicality of the transformation and the goals and means of the transformation); and

b) the characteristics of the main characters (e.g. the HEI, the instructors, and students).

The shared factors are similar to Venkatesh et al.'s (2012) measure for adopting an innovation. The factors also espouse the concerns affecting the continuance use of innovation after implementation. Concerning the two main stakeholders in the classroom, instructors are likely to reject an innovation if it is too complex, unclear and difficult to implement and seems impractical for teaching (Ketelhut & Schifter, 2011). Instructors or teachers in recent times have also bemoaned the lack of time to practice and develop an interest to see the application of technology used in the classroom to fend off innovation rejection. Similarly, if students and the learning environment are not supportive of the transformation, embracing the innovation will be difficult. These factors often stem from a lack of technology support staff, the anxiety of failure and low perceived self-efficacy (Raeder *et al.*, 2019). To understand the facilitating conditions and player type of the target audience, El-Masri and Tarhini (2015) provide seven strategies for transforming education with games, as shown in Table 3.1. When systematically followed, these strategies (focusing on software and system requirements, project phases, adoption, and support processes) benefit both instructors and students and ensure the continuation of the innovation.

The results of the evaluation of the target audience also indicate that the player plays a key role in addressing the issues affecting continuation of the innovation after it has been implemented. As such, understanding the type of players is important to enhance GIS in learning.

Table 3.1 Gamification Design Principles in Education

Gamification Design Principles	Approach
Principle 1	Adapt – purposefully build educational games to adapt to education systems and purposes
Principle 2	Scale – purposefully build educational games to scale that can achieve the intended purpose and goals
Principle 3	Configurable – build educational games platforms that are highly configurable to educators' modification with ease
Principle 4	Access – allow educators free access to enable or disable personification features and other game design elements
Principle 5	Create – GIS platforms must allow educators to create competitive and cooperative games that promote class-based interactions
Principle 6	Loops – GIS platforms must allow "pleasurable feedback loops" between students and the gamified system
Principle 7	State of flow – the GIS must constantly keep students' state of arousal and maintain a challenging learning environment to improve their skills

Adapted from El-Masri & Tarhini (2015)

There are four main types of players a) *Achievers* – players who achieve status and ranks due to high-performance level; b) *Killers* – compete and play against other players c) *Socialisers* – collaborate with other gamers and are good team players and d) *Explorers* – purpose to discover stuff and collect virtual goods (Folmar, 2015). In the classroom, instructors prefer players (learners) to be on the achiever's level to meet the learning objectives and goals of the course. Hence, the focus of this research is on the achievers. However, Kim (2014) posited that the player type is loosely aligned to learning behaviours. Hence, a learner may exhibit more than one player type or characteristic for an intended interaction or achievement. However, it is not always obvious to predict game success with the known player types.

3.2.2 Survey of Evidence on Gamification in Education

Educative behaviours include behaviours that are undertaken by learners to gain course understanding and reshape their learning styles to engage in collaborative work facilitated by

technology (Ketelhut & Schifter, 2011). Students' collaborative engagement includes computer programming learning, discussion and taking quizzes. In this regard, many GIS has been developed for teaching and learning. An example is gamified *Anti-plagiarism* which is a game-based plagiarism detection software (Pelopida & Kokkinaki 2014). Players assume the role of the developer and assess their writing accuracy and mission to protect research integrity. The players are awarded points based on their level of accuracy and integrity. The points rewards can be likened to information quality which comprises accuracy and currency of information. *Hard Struggle (HS)* was designed to expose the youth to different career opportunities (Shipepe & Peters, 2018). The HS career guidance game was co-designed and co-created with high school learners, and university and vocational students to mimic their experience (*aesthetic experience*) in job search in the system. The HS also challenges the youth to explore their skills *(IT capabilities)* in job search and then think and act. *Gamified Moodle Learning Management System (GMLMS)* was designed to help students learn the "Object-Oriented Design Methodology" course to establish the different personality traits (Denden *et al.*, 2018). The game elements employed *competence*, *social relatedness*, *motivation*, and *autonomous* feeling. The GIS presents a measure of success accumulated (*motivation*) as a result of executing activities *(competence)* in a social online environment (relatedness). The rank of students (performance expectancy) and progress were also shown (effort expectancy) on the leaderboard. The GMLMS increased the student's ability and capability (competence). The study observed that personality trait influences learners' perceived preferences of game elements. For instance, while introverts did not prefer game elements like the progress bar and leaderboards in learning, extrovert learners prefer these game elements. Theoretically, UTAUT and SDT have been used to inform gamification research on human behaviour. For example, van Roy and Zaman (2019) evaluated the ambivalent motivational power of gamification with *Google+ Community* to help write two assignments about a central topic in Human-Computer

Interaction (HCI). The gamified *Google+ Community* employed three strategies to motivate behaviour change and engage players. These included 71 non-announced digital badges – increasing *rewards*, 12 weekly challenges – increasing *engagement* and a group competition - impacting skills to overcome course difficulty. The results of the evaluation revealed that the *gamified Google+ Community* impacted students' autonomous feelings and the badges and group competition rankings provided students' need for competence. The group competition also afforded students a feeling of social relatedness and improved class interaction among the groups. Table 2.2 provides a summary of the theory-driven gamification studies.

Table 3.2 shows empirical research on gamified activities, related theories and entails different combinations of game elements and behaviour change outcomes. Without a discernible systematic experimental approach, it is difficult to identify which game elements or configurations are most effective in promoting engagement and supporting learning for a group of learners (Dichev & Dicheva, 2017). By adopting a systematic experimental approach, future research can map out the effectiveness of game element configurations in supporting learners.

Main gaps underlying this study from the literature review

From the literature analysis, I found that due to the lack of readily available guidelines, there is low ***adoption*** and ***acceptance*** of gamification systems coupled with a one-size-fits-all approach which makes the adoption more complex in DE. Interestingly, how these GIS ***motivate and engage*** students, results in mixed findings with unexpected failure of gamification intended purpose. Also, I found inconsistencies in the results of GIS evaluation with respect to ***continuance intention to use*** for a specific target audience. Thus, the general overarching question guiding this thesis is: *how can gamification be tailored to students to enhance their engagement in motivating behaviour change in education?*

Table 3.2 Game Elements for Education

Preferred Game elements	Content gamified	Related theory	Reference	What was found
Points, badges and rewards	mHealth App – measuring blood glucose level Electrical course	n/a *Positive outcomes*	Adukaite *et al*. 2017 Aldemir, Celik & Kaplan, 2018 Bitrián *et al*. 2021	***Motivation and engagement*** ➢ Understanding of topics ➢ Positive study habits and a sense of wellbeing ➢ Involvement and participation; Learner interest ➢ Enjoyment, excitement, and heightened self-regulation ➢ Collaborative tools for enhanced learning
Badges, status, points and graphical rewards	Social interaction forum Teaching physical activity	Intrinsic and extrinsic motivation **Positive and negative outcomes*	Gibson *et al.*, 2015 Thom *et al.*, 2012 Consolvo *et al.*, 2008 Legaki *et al*. 2021	***Challenges, motivation and demotivation (mixed results)*** ➢ Dislike online activities and distractions ➢ Poor student online attendance ➢ Huge volume of work ➢ Feeling connected ➢ Autonomous feeling ➢ Unclear student expectation ➢ Task requirements led to confusion ➢ Task incompletion unless exams/quizzes ➢ Social isolation and anxiety ➢ Class interaction with lecturers reduced
Leaderboards and points	Computer environmental course	knowledge-based view theory, employee engagement theory, SDT	Gnauk *et al.*, 2012 Janson, Söllner & Leimeister, 2017 Hakak *et al*. 2019	
Progress bars and rewards Graphical rewards, levels, feedback, and points	Teaching e-learning software and Courses in health and sustainable behaviours Computer software course	Behaviourism/ learning theory Motivational theory *Positive and negative outcomes*	Raymer, 2011 Lui *et al*., 2011 Berkling & Thomas, 2013 Alexiou & Schippers, 2018	***Collaboration*** ➢ Easily corrected gamified quizzes ➢ Recordings are available and video on replay for better understanding ➢ Online discussion and debates ➢ Audio of lecturers ➢ Live and instant assessment results ➢ Avenue for peer assessment ➢ Experiments with group ➢ Improvement in technological skills ➢ Feeling comfortable interacting with peers online ➢ Opportunity for parental support and involvement ➢ Increased aesthetic experience
Points and leaderboards Progress bars, points, leaderboards, charts, and timers	Electronic media course; Teaching software engineering. Gamified quiz Teaching modules	Situated motivational affordance Mediators from Technology acceptance *Mixed outcomes*	Kumar & Khurana, 2012; Hamari & Kovisto, 2019 Filippou *et al*., 2018 Hanus & Fox, 2015 Jiang *et al*., 2016 Parra-González *et al*. 2021	
Leaderboards, ranks, points, real-world rewards, challenges, levels	Virtual 3D avatars development course. Teaching a computer engineering course	n/a ***Positive outcomes*	Featherstone & Habgood, 2019 Barata *et al*., 2013 Alahäivälä & Oinas-Kukkonen, 2016 Suh *et al.*, 2017	***Self-determination*** ➢ Competence ➢ Social belongingness ➢ Positive interaction with peers ➢ High concentration ➢ Involvement/participation ➢ Self-regulation on platform ➢ Positive attitude towards class activities and learning

**Participants' motivation declined significantly with the removal of game elements*
***Participants cheat when there is a lack of motivation since they want to progress in the line of duty meaningfully.*

The review of gamification in education reveals that game elements can be theoretically and practically developed to inform the design that affects effective teaching and learning in HEIs.

3.3 RESEARCH GAPS FOR FUTURE GAMIFICATION RESEARCH

The review of existing literature on gamification shows that several factors must be considered when implementing gamification in DE, particularly the proposed gamification framework. Future research frameworks need to consider the motivational affordances, psychological and behavioural outcomes (Deterding, 2015) the need for the evaluation and cooperative approaches to the proposed framework. By cooperative strategies, Deci and Ryan (2000) advocate for a sense of relatedness to engage users towards a particular system as human beings are social elements. Additionally, while gamification has been a success in developed economies like Finland, the US, and Canada, developing economies cannot say the same. Thus, the cultural, political, economic, social environment and outdated educational materials should be considered prudently and reasonably.

Moreover, organisations and educational institutions would have to change their traditional and organisational ways of engaging employees, students, and customers (Agbatogun, 2010). Though the review has identified several gamification frameworks (mostly proposed but not evaluated frameworks) in the DE context, there is the need to adopt the successful, evaluated and tested gamified frameworks from the developed economies; notwithstanding the cultural fit of such systems. Similarly, future research should integrate the contexts (e.g. culture, discipline, level of potential users, types of feedback, individual affordances - personalisation) in which gamification is implemented. The following are the proposed questions for future studies: what techniques should organisations adapt and diversify to create gameful motivational affordances among potential users in developing economies? What are the process

and procedures (predeterminants of successful gamification) organisations should undertake while adopting gamification in developing economies?

While a substantial part of gamification literature has been applied to today's activities, to motivate users and make monotonous tasks more enjoyable; some issues hinder the development of the area. First, the methods and research models used in studying gamification research are scattered and primarily unclear. For example, two studies examining excitement in GIS used different validated measurement instruments (Filippou *et al*., 2018; Featherstone & Habgood, 2019). Only a few studies have used similar validated measurements, which poses a challenge when conducting a meta-analysis or comparing research results. Second, there is little empirical evidence to demonstrate that gamification satisfies users' intrinsic needs beyond optimistic expectations. Previous reviews suggest that there is lack of studies on gamification research that systematically investigate the effect of game design elements on user psychological and behavioural outcomes (Nacke & Deterding, 2017), the question this review poses for future studies is: what are the theoretical explanations underlying the role of gamification in satisfying users' needs (intrinsic)? Thus, this research seeks to address the lack of empirical and validated measurements, which pose replication challenges to future research on GIS.

3.4 CHAPTER SUMMARY

This chapter presented a review of gamification in education to ascertain the current state of its application. The chapter focused on deconstructing gamified systems with an emphasis on two main areas: transformation in higher education and a survey of evidence on gamification in education. Further, it acknowledges that with the current strides of gamification, future studies should provide a theoretical guideline understanding of the different learners and provide a framework necessary to thrive in DE.

CHAPTER FOUR

THEORY-DRIVEN GAMIFICATION FRAMEWORK

4. OVERVIEW

This chapter presents a theory-driven integrated framework that underscores the importance of understanding the user. The framework employed the unified theory of acceptance and use of technology (UTAUT), self-determination theory (SDT) and motivation opportunity ability (MOA) theory through the lens of persuasive system design (PSD). Based on the drawbacks of the UTAUT, SDT and MOA theory, three research models were proposed in line with the research objectives.

4.1 THEORY IN GAMIFICATION RESEARCH

Prior studies indicate that the word 'theory' can take several forms of meanings, such as a "mental view" or "contemplation." The OED (2004) defined it as a system of ideas or statements held as an explanation or account of a group of facts or phenomena or a hypothesis that has been confirmed or established by observation or experiment. These forms of meanings (theory) constitute the foundational blocks of scholarly research that guide IS researchers to organise their perspectives and ideas (Gable, Sedera, & Chan, 2008).

For that reason, there are differences in views of a theory that depends on scholars' disciplinary orientations and philosophical views (Miles, 2012). However, there are commonalities to explain how social realities work (Miles, 2012). These include explanations or constructs, predictions, and testing (Miles, 2012). Explanation – focus on how, why, and when things happened. Prediction – states what happens when certain preconditions are constant or held. Testable – statements of the relationship between constructs in a form that can be tested empirically.

These goals are the foundation upon which a behavioural change is evaluated and designed in explaining a phenomenon. Theories provide many benefits for conducting IS research, particularly in analysing, explaining, predicting, designing, and to better understand the real world (Hanseth & Lyytinen, 2010). Following this, a theory-driven approach is proposed to outline the relevant framework for promoting desired behaviours with gamification.

4.2 DEVELOPMENT OF A THEORY-DRIVEN INTEGRATED FRAMEWORK

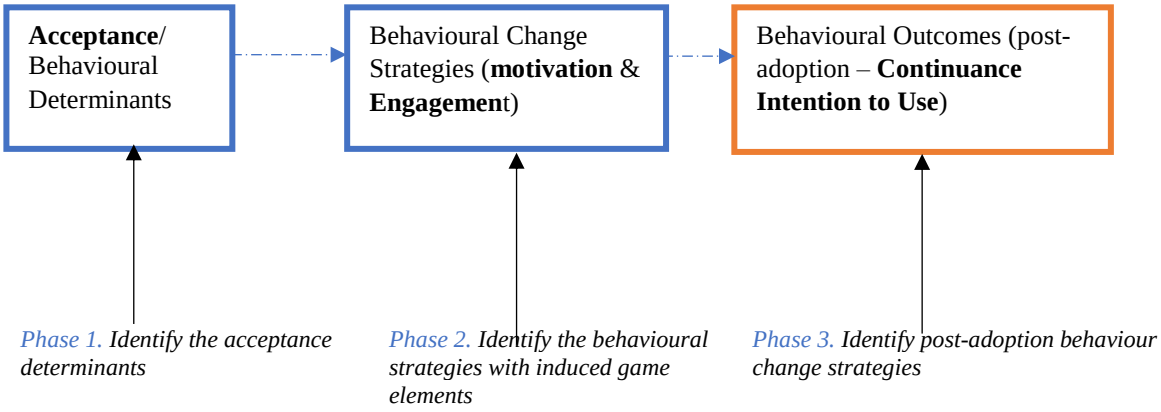
To answer the research questions, this thesis proposes a theory-driven integrated framework for tailoring GIS in education based on the persuasive system design model. The Persuasive Systems Design (PSD) model is a framework used to develop or evaluate persuasive technologies like gamification (Michie *et al*, 2008). It emphasizes the factors that influence the target system and underscores the importance of understanding the user. Despite the importance of PSD as a guide for developing persuasive systems, there remains a paucity of evidence on how to evaluate theory-driven GIS by integrating behavioural antecedents into their framework. Without referencing existing behaviour theories, it becomes difficult to understand the factors that influence the intended user. As a result, I conceptualised and developed a model based on the PSD framework to highlight the steps that could be followed by GIS developers and evaluators to achieve theory-driven GIS (see Figure 4.1).

According to the PSD framework, there are two (2) main phases to follow to achieve a theory-driven behaviour. The first consist of identifying the antecedents that can influence behaviour in the target audience. There are two ways to identify the appropriate antecedents in a specific context a) systematically reviewing adoption and behavioural theories to reveal relevant and dominant determinants. Most of these adoption theories have been examined from a single theory or a combination of theories to predict an outcome; and b) practically apply the antecedents in a theory-driven GIS to a target population (Orji, 2014). Due to gamification

infancy and the lack of researchers in developing economies to analyse, evaluate and develop a theory-driven GIS for students in HEIs in DE, most instructors and practitioners often ignore the second phase – applying the identified antecedents to the target group in HEIs. Due to the complexity of the DE environment, ignoring the suitable antecedents is a recipe for system failure by the target group – i.e. matching the right target users with the wrong antecedents.

The second stage is to analyse the gamification system. According to the framework, for a GIS to be persuasive, the persuasion process must be analysed in the (use) context of the target group. A clear understanding should be established in identifying the role of the persuader (i.e. game design elements), the persuade (students), the channel of communication (e.g. Kahoot, Blackboard) and the message being communicated. Notwithstanding, the user context needs to be analysed to determine the user's needs, motivations, interests and abilities. Importantly, this stage involves identifying strategies and techniques necessary for behavioural change. As shown in Figure 4.1 this thesis is classified into three phases needed to establish a theory-driven framework for gamification in HEI in DE. Phase 1 – identify the adoption/acceptance determinants necessary for hosting gamification. Since this study on gamification is new, it was difficult to skip this phase. However, future studies may consider this phase as optional or start from Phase 2 – identify behavioural change strategies and game elements. Phase 3 – considers the post-adoption behaviours or outcomes of behavioural change strategies necessary for using GIS in the long term.

Figure 4.1 Theory-Driven Gamification Research Framework (*adapted from Michie et al, 2008)*



(Resulting from UTAUT, SDT and MOA theory)

Based on the three phases, this thesis presents a combination of theories that assert that the use of gamification in education is determined by its acceptance (UTAUT), the level of engagement and motivation of the system (SDT), and factors that determine its continued use (MOA theory). The theories are used in different research frameworks but with the same motivational ambition (aimed at the research questions) to focus on the educational-context conditions that enable and predict self-motivation towards GIS. Thereby, instructors, designers and researchers need to identify suitable strategies for the target audience (learners) in HEIs in DE. The reason is that more than one strategy can be used to influence change but there is no clear mapping of strategies and determinants in the gamification literature. It should be noted that data was collected at each phase from similar population, hence there is no direct relationship between the phases. Arguably, this is the first study to establish such a relationship in a post-study framework. The next section explains the UTAUT, SDT and MOA perspectives as a theoretical lens for the theory-driven GIS framework, which provides the basis for addressing the research problems of this thesis.

4.4 UNIFIED THEORY OF ACCEPTANCE AND USE OF TECHNOLOGY

To explore students' gaming experience, perception and acceptance of adding game design elements to learning in higher education institutions in a DE context (evidence from Ghana), this study adopted the UTAUT. Venkatesh *et al.* (2003) proposed the UTAUT based on a review of extant literature as a comprehensive synthesis of previous technology adoption research. UTAUT has four main constructs (namely performance expectancy, effort expectancy, social influence and facilitating conditions) that influence behavioural intention to technology use.

Since UTAUT's original publication, it has served as a baseline model for investigating different technologies in various organisational and non-organisational settings. To strengthen its generalisability, researchers and practitioners have applied and replicated part of the model or the entire model in an organisational setting (see Neufeld *et al*., 2007). UTAUT integrations or extensions have three broad types – the first integration type examines UTAUT in new contexts, such as developing economies (e.g. Ghana, Nigeria; see Kolog *et al.,* 2015; Boateng *et al*., 2016), new technologies (e.g. motivational information systems – serious game or gamification, collaborative systems; see Koivisto & Hamari, 2019), and new cultural environments (India, Indonesia; see Gupta *et al*., 2008). The second integration focused on expanding the scope of endogenous theoretical mechanisms drawn in the UTAUT model by adding new constructs (Sun, Bhattacherjee & Ma, 2009; Vatanasakdakul, Aoun, & Putra, 2020). This integration helps to predict the UTAUT variables and broaden understanding and knowledge of technology adoption in a specific context e.g. higher education. However, most studies that employed UTAUT used only a subsection of the constructs, while others dropped the moderators (see Venkatesh *et al*., 2012). Notwithstanding the contribution of the various studies in championing understanding of the usefulness of UTAUT in specific contexts, there is still the need to theorise salient factors that would apply to gamification and help unveil the

relevant factors essential to potential users. The following section highlights the definition and constructs of UTAUT as applied to students in higher education in Ghana.

4.4.1 UTAUT CONSTRUCTS

Performance Expectancy refers to the extent to which technology is perceived by an individual to improve job performance – it consists of extrinsic motivation (Davis *et al*., 1992), perceived usefulness, outcome expectation and relative advantage (Compeau *et al.,* 1999). *Effort Expectancy* represents the ease of use of technology as perceived by an individual. Effort Expectancy encompasses three constructs:

(*a) Perceived ease of use;*

(b) Complexity associated with the task derived from the model of PC utilisation; and

(c) Ease of use (Thompson et al., 1991).

Social Influence is the extent to which another individual impacts one's decision to use technology. *Facilitating Conditions* represents the organisational support available to potential users for the use of the system. According to UTAUT, facilitating conditions and behavioural intention determine technology use, while performance expectancy, effort expectancy and social influence are conceptualised to influence behavioural intention to technology use (Ventkatesh, Thong & Xu, 2012). Attitude has also been highlighted as an indirect determinant of the UTAUT model and represents the pleasure linked to the use of technology (Venkatesh *et al.*, 2003). Behavioural intention is also defined as a measure of the strength of one's intention to perform a specific behaviour (Fishbein *et al*., 2001).

Additionally, individual differences such as age, image and trust are theorised to influence behavioural change. Although trust has been examined in literature in a different context, the use of trust in this thesis is to measure the *trust level* with higher education *services* and the *quality* of the targeted learning management systems to host gamification.

4.4.2 APPLICATION OF UTAUT TO EDUCATION RESEARCH

Advances in technology bring about changes in society, which in effect dictates societal trends. By acquiring IS services, an individual learns about object properties or materiality in his social or organisational settings (Robey, Anderson & Raymond, 2013). In observing individuals and objects in separate attributable properties, objects are perceived to assume two forms of beliefs or perception: belief in objects and belief about objects. The former relates to the existence or nonexistence of an object as perceived by the individual. In contrast, belief about objects is the relationship that exists between objects (the given objects and others - concepts and values) (Jasperson *et al*., 2005). The evaluation of the object is related to how the individuals feel about the objects in the belief or perceptual process. Consequently, attitudes are formed due to evaluated beliefs of personal feelings (favourable or unfavourable) towards a given object. The formation of attitudes resulting in behavioural change towards an object ideally aligns with the individual's attitudes (Ngampornchai & Adams, 2016). However, there are extraneous cases of inconsistent attitudes with observed behaviour due to constraints mediating between the actual use behaviour and the individual's predisposition. These constraints predominate the effect of attitude. Designers of gamification in such a context cannot assume that users have reached a certain level of technological competence or represent a homogenous group or attitude but relatively must appreciate the diversity that gamification offers.

Attitude formation is thereby influenced by the user's belief (Barnes & Kennewell, 2017) of the quality of the current system, beliefs about capabilities, trust, availability, and ease of use before integrating gamification. It must be noted that beliefs about GIS contribute to the user's attitude toward game elements in education. The primary fundaments necessary to accept and use GIS include familiarity with technology, performance and effort expectancy, image, facilitating conditions and social influence.

Depending on user context (place), situational constraints like the high cost of data, LMS unavailability, poor internet connection, computer facilities, and inadequate or unavailable user/management support may intervene between attitude and usage behaviour in a DE. These contributing factors sum up the individual belief system in adopting GIS which informs designers of user preferences and expectations. Technology affordance and its relationship with gamified systems should be considered in research for more exceptional learners' engagement. Thus, understanding the learners and the environment is a vital recommendation for educational institutions planning to adopt gamification. This study, therefore, focused on user perception or attitudes toward gamification in learning in Ghana. Three sets of variables can be deduced from the UTAUT model for this study: 1) the perception of gamification, 2) external variables outside gamification that may affect attitudes toward the gamified system 3) attitudes towards games and use of GIS.

According to Moore and Benbasat (1991), how individuals perceive IS determines their use and dimensions and features. The dimensions necessary for behavioural change include the following four criteria: 1) the perceived usefulness to the gamified user, 2) element of game flow – excitement in system use 3) common to all game-based information systems 4) significance to the study's theory.

As captured in the model, perceived usefulness is the possibility that using a target system improves and motivates the potential user. In contrast, perceived ease of use denotes the effortless nature of the target IS as perceived by the potential user (Thompson *et al.,* 1991). However, other external variables may influence the potential user's attitude to the system.

The proposed research model reflects the belief systems as favourable or unfavourable. Thus, a set of 5 consequences (measurement items) of LMS use was developed to test GIS adoption. Two of the items reflect direct outcomes of internet services and the capability of the IT unit

to support gamification services. The other three items focused on the quality dimensions, system organisation and attractiveness, and system availability. These evaluative beliefs result in the behavioural process and assessment of beliefs towards a system. The Ghanaian educational environment necessitated the construction of these attitude beliefs after an interview with chief information officers, instructors and students.

In summary, for gamification to be proven effective and successful, it is dependent on users using the gamified system in learning. The study, therefore, explores the student's behavioural intention to use the application. Future studies can investigate the effectiveness of game design elements after the integration.

4.4.2.1 CRITICISM OF THE UTAUT THEORY

Notwithstanding the utility of UTAUT model in adopting technology, it has some criticism. Researchers have criticised UTAUT for excluding new endogenous mechanisms (NEM) (Maruping *et al.*, 2017). NEM refers to the enhancement of the four exogenous variables (i.e. performance expectancy, effort expectancy, social influence and facilitating conditions) or how new predictors impact behavioural intention and use behaviour herein referred to as the two endogenous variables. For example, Venkatesh *et al.* (2008) introduced a predictor – (*behavioural expectation*) to address fundamental limitations of the theory that provided a better understanding of system use. Thus, the scholars examined system use in duration, frequency and intensity. To this end, this thesis introduces institutional-based *trust* as a new endogenous mechanism to address how a higher education infrastructure can positively affect students' intended use of new technologies.

4.4.3 HYPOTHESIS DEVELOPMENT

In recent times, the acceptance of education technology decisions has been characterised based on a robust utilitarian motive – productive outcome of systems. One of the strongest predictors

of adoption and use behaviour which has been applied across different models and validated in the workplace and learning environment is the *use-productivity contingency* – e.g. job fit, ease of use and relative advantage (Sun, Bhattacherjee & Ma, 2009; Barnes & Kennewell, 2017; Vatanasakdakul *et al.*, 2020). The motivation of the hypothesis development is based on this principle to influence the concept of behavioural change with gamification – herein defined as applying game design elements to promote and enhance learning. In the school setting, contrary to the work environment, the fun/excitement students exhibit influences their decision to adopt. The following sections detail the hypothesis development for the study.

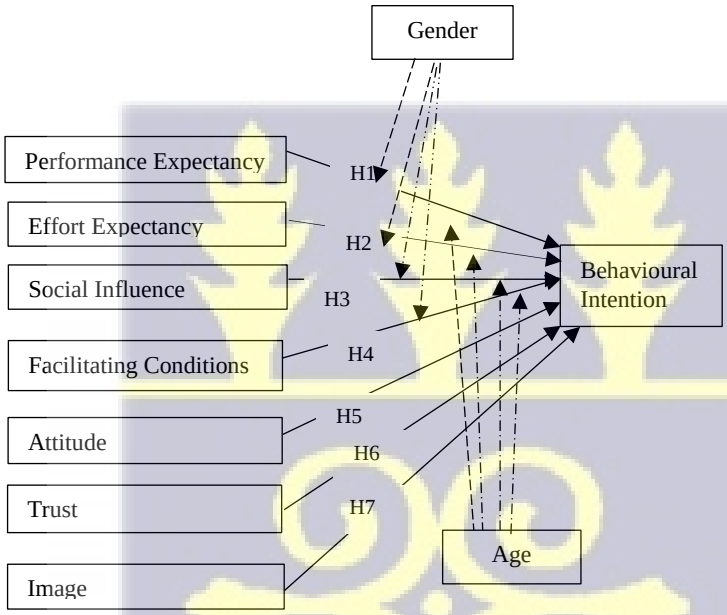


Figure 4.2 Conceptual Framework on Acceptance

4.4.3.1 Performance Expectancy (PE) on Behavioural Intention (BI)

The adoption of learning systems has been a critical question among academics and practitioners. The role of perceived usefulness has been important in decision-making for users when adopting technologies and services for teaching and learning (Liu *et al.*, 2009). The idea of using technology to enhance performance makes potential users more prone to adopt it. It has been found that individuals learn to use technology with ease if they have prior experience

with similar technologies or if the features are standard and known to them, this is similar to Roger's (1995) adoption of innovation. Thus, the benefit derived from a particular technology is not immediately evident until after a period of use. To this end, adopters who are sceptical learn by observing the results from others' adoption behaviours and subsequently, infer the value of adoption and performance of use (Neufeld, Dong & Higgins, 2007). According to Venkatesh *et al*. (2003), performance expectancy is considered a strong positive predictor of learners' intention to use technology. Similarly, Khechine *et al*. (2016) found that the eagerness associated with adopting technology is due to its perceived effectiveness, efficiency and hedonic returns. This study, therefore, proposes the following hypothesis:

H1: Performance expectancy influences behavioural intention to use gamified IS in learning.

4.4.3.2 Effort Expectancy on Behavioural Intention

As indicated earlier, effort expectancy is the perception of ease of use of technology (Venkatesh, Thong, & Xu, 2016). In the context of education, this construct refers to the ease of using GIS by the students. Prior studies have found that there is a significant and positive relationship between effort expectancy and behavioural intention (Martins, Oliveira, & Popovič, 2014; Venkatesh, Thong, & Xu, 2012). The supporting principle guiding this relationship is that *"easy-to-use systems"* make users more willing (freewill) to adopt them (Martin *et al.*, 2014). Consequently, this study proposes testing the following hypothesis:

H2: Effort expectancy influences behavioural intention to use gamified IS in learning.

4.4.3.3 Social Influence (SI), Facilitating Conditions (FC) on Behavioural Intention (BI)

A critical factor for predicting behaviour change and intention to use technology is social influence (Venkatesh *et al.*, 2003; Venkatesh & Zhang, 2010). The *Theory of Reasoned Action* has advanced insight on technology acceptance and human social behaviour and inspired most

of the conceptual frameworks in behaviour change. It assumes that an individual's behavioural intention is rooted in attitudes and subjective norms, and these intentions result in actual usage behaviour. Several studies have found a positive association between behavioural intention to use education technologies and attitude towards usage (Saade & Galloway, 2005; Liu *et al.*, 2009; Lee, 2010). Thus, attitude is the weighted sum of a person's beliefs concerning a specific behaviour. At the same time, the subjective norm is the influence of a person in his/her environment concerning a particular behaviour (also called weighted perceived norms). To this end, one's behaviour is influenced in a way that makes them believe that those close or important to them think that a particular behaviour should be followed or discontinued. Venkatesh and Davis (2000) found that the presence of SI weakens with time in instances where use is mandatory to the users, and it becomes unnecessary when technology usage is constant. However, in the early stage of technology use, it is important (Chen, Zhang, Gong, Lee, & Wang, 2020).

UTAUT also suggests that ***facilitating conditions*** **(FC)** consist of perceived behavioural control and compatibility which directly influence use behaviour (Thompson *et al.*, 1991; Ajzen, 1991). While SI shows how individuals perceive that close relations believe they should use a particular technology as part of learning, FC focus on how an individual believes that the educational institution's infrastructure and support unit exist to assist them in using the technology (Dwivedi, Rana, Jeyaraj, Clement, & Williams, 2019). In the context of education, SI refers to the views of friends, course-mates, instructors, family members and friends concerning the use of the gamification application while FC consists of human, technical or institutional support for students' use of GIS in learning.

Attitude (ATT): Additionally, based on the UTAUT, this study analyses the relationship between students' attitudes and readiness to use game design elements in their studies. The role

of attitude is critical in educational decisions and the learning environment (Mazana *et al.*, 2019). Attitude becomes even more critical in the case of mobile technologies for learning as this platform-based learning is limited in informing users whether the information and content provided is trustworthy and accurate and not a waste of time, compared to traditional teaching methods (Akturan & Tezcan, 2012). Since attitudes have been highlighted as an indirect determinant of the UTAUT model and represent the pleasure linked to the use of technology, this study assumes a positive relationship with students' behavioural intention to use GIS. The following hypothesis is constructed based on the above reasoning:

H3: Social influence influences behavioural intention to use gamified IS.

H4: Facilitating conditions influences behavioural intention to use gamified IS.

H5: Attitude influences behavioural intention to use gamified IS.

4.4.3.4 Trust (TR) and Image (IM) on Behavioural Intention (BI)

Trust is defined as a positive attitude and expectation towards others and the degree of confidence one can depend on others (Dietz, 2011). Building trust takes a long time, and it is a critical factor that inspires students' behavioural intention. In IS research, trust is an enabler which facilitates technology and continued use behaviour (Schuetz & Venkatesh, 2020). Trust-building is a long-term process and in educational institutions, it is a critical factor to determine students' behavioural intention to use a platform-based learning system. For instance, Upadhyay *et al.* (2021) used an integrated framework to study adoption issues in platform-based learning systems and mobile-based systems and found that trust is a critical determinant of behavioural intention to use IS in developing economies. Other studies have reported the impact of repeated trust-building on behavioural intention (Li, 2021).

Previous works highlight the importance of enhanced levels of trust-building in education. Specific beliefs about a system or an educational institution championing IS for learning are

associated with enhanced levels of intended use. Further, certain aspects of an educational system are increased by perceived usefulness (Bøe, 2018). The usefulness of IS depends on the expertise or the human services behind the IS and the relevancy of the deployed technological properties for the students. Suppose students perceive poor information quality or lack of help-desk support in using a system. In that case, the system's likelihood becomes low, leading to discontinuance use and future system rejection (Chiou, Schroeder, & Craig, 2020). Thus, the extent of the expertise or human service behind the technology makes the non-technological aspect of IS effective for continued use and promoting the institution's value-for-money agenda.

Concerning the long-term benefit of educational technologies to teaching, non-teaching staff and ultimately the students, trust should increase the performance expectancy and effort expectancy of the engagement and interaction through the GIS. In this case, using game design elements that have cultural meaning to learning and not a borrowed game element all in the name of a one-size-fits-all game element approach should be used (Rai & Selnes, 2019). This ties into the two-fold nature of gamification as information technology and social relatedness interface. When students perceive the institution's infrastructure, IT personnel and management as trustworthy, it makes championing new technologies to the extent that students are willing and not forced to learn via the game design elements (Zhang, Meng, de Pablos, & Sun, 2019).

The more trustworthy students are towards the institution's infrastructure (IT, human resource and IT services) that enable them to accomplish learning tasks, the more their readiness to embrace new technologies. Thus, the educational institution and its environments are key factors in trust-building in technology and mobile-based learning compatibility. Based on the above assumptions, the trust component refers to institution-based trust. Institutional-based trust is the belief that the environment in which one thrives has appropriate safeguards and

protections for the intended purpose (McKnight *et al*., 2002). The two main dimensions of institutional-based trust is *structural assurance* – the belief that structures are in place to promote success or enhance teaching and learning, and *situational normality* – the belief that success is likely to happen because the environment is in proper condition and the situation is favourable and normal for teaching and learning (McKnight *et al*., 2002). The measurement items in this study are based on structural assurance. The reason is that institutional-based trust can predict trust in online learning and environments better than situational normality.

Concerning image, Moore and Benbasat (1991) discovered that individuals in an organisation who use a particular application have more prestige than those who do not use. Further, they found out that individuals with the system revealed a status symbol in the organisation. This led to the image construct as an addition to the UTAUT model. Venkatesh *et al.* (2003) defined image as the "degree to which the use of innovation is perceived to enhance one's image or status in one's social system", p.10. Thus, the more favourable an individual perceives the image, the more likely he or she is prone to use. However, Calisir et al. (2014) found an insignificant relation between image and behavioural intention to use technology in DE. To the scholars, the users rather focused on the system's usefulness than the status symbol and prestige associated with the system; hence recommended a critical look at image when applying a system in developing economies. Consistent with Calisir *et al.* (2014) results, behavioural intention to use gamification is not influenced by image. Accordingly, the following hypothesis is posited:

H6: Trust in an institution's IT infrastructure influences behavioural intention to use gamified IS.

H7: Image influences behavioural intention to use gamified IS.

Consistent with the underlying constructs of intention models (UTAUT) discussed in this thesis, this study expects behavioural intention to influence gamification use significantly.

4.4.4 Moderating Effect of Gender and Age within UTAUT

Gender and age affect technology adoption and use. The age and sex of students at the various levels of the educational life cycle tend to have different perceptions and behaviour in decision-making situations. Prior studies show the important role it plays in predicting use behaviour in IS research (Wang *et al.*, 2009; He & Freeman, 2010). For instance, the predictive power for TAM was significantly increased by 52% after including the two moderators in Venkatesh *et al*.'s (2003) study. The following are justifications for including gender and age moderators with the core UTAUT tenants.

Performance Expectancy (PE). Earlier studies have found the influence of gender on moderating the relationship between PE on BI. For instance, Venkatesh et al. (2003) found gender as an important moderator that influences PE and BI. Their findings were significantly stronger for men than women. Hofstede (2005) supports this finding by stating that men are highly task-oriented and more motivated by the need for achievement compared to women. Thus, the men prioritise system usefulness more (Terzis & Economides, 2011). However, Wang *et al*. (2009) found no moderating effect of gender on PE relationship with BI in an e-learning context.

Further studies have found that age is an important moderator within the UTAUT model. For example, Venkatesh *et al*. (2003) reported that the relationship between PE and BI is stronger for young employees within an organisational context. However, there have been contrasting studies to support this effect. Wang *et al.* (2009) found no moderating effect of age on PE relationship with BI to use mobile learning in an e-learning context. Therefore, this study hypothesizes the following:

H1a: Gender and age moderate the relationship between performance expectancy and behavioural intention.

Effort Expectancy (EE). Research suggests that important demographic variables such as age and gender are found to directly moderate the effect on technology adoption, acceptance and behavioural intention (Chung *et al*., 2010). Prior studies have reported that users' intention to adopt a system is highly affected by EE for females than males (Venkatesh *et al.,* 2003). The finding of this study is consistent with Tarhini *et al*. (2014) results. However, the result is inconsistent with Wang *et al.* (2009) findings, who failed to find the moderating effect of gender on the relationship between EE and BI in an e-learning environment.

Further, studies have found age as a direct and moderating effect on the relationship between EE and BI within the UTAUT model, and the relationship is significantly stronger for older users (Venkatesh *et al*., 2003; Tarhini *et al*., 2014). While Chung *et al*.'s (2010) study is inconsistent with this result, i.e. failed to account for the moderating effect of age on EE on BI, Wang *et al*. (2009) and Tarhini *et al*. (2014) provided support for the results in the e-learning context. Therefore, the study hypothesizes the following:

H2a: Gender and age moderate the relationship between effort expectancy and behavioural intention.

Social Influence (SI). Venkatesh *et al*. (2003) found that the effect of SI on BI was moderated by age, and the impact was more significant among older workers. Further, Morris and Venkatesh's (2000) study on IS use by financial firms reported the significant moderating influence of gender and age on the relationship between SI and BI. Furthermore, numerous studies have found that gender affects the relationship between SI (i.e. normative beliefs) and BI. The effect is stronger for women than men (Huang *et al*., 2012; Tarhini *et al.,* 2014). Previous studies have also found that women are more easily motivated by SI and pressure and

rely more on opinions than men (Venkatesh & Morris, 2000). Thus, women have a greater awareness of others' attitudes and feelings than men (Hofstede & Hofstede, 2005). On the other hand, Wang *et al.* (2009) study on m-learning acceptance found that SI effect on BI is more evident for males than females. Contrarily, Wang *et al.* (2009) found that age moderates the relationship between SI and BI. Also, the study found that the effect of the relationship is stronger among older adults because of their need for affiliation. To this end, the study hypothesizes the following:

H3a: Gender and age moderate the relationship between social influence and behavioural intention.

Facilitating Conditions (FC). The consideration of gender and age in FC was proposed in Venkatesh et al. (2003) study. However, only age was tested and validated in the results. Hence, future studies have explored genders' important role in moderating the effect of FC on BI in the acceptance of technology (Chang et al., 2019). In detail, Venkatesh et al. (2003) found that age moderates the relationship between FC and BI. Their findings were significantly stronger for younger users compared to older users. Binde and Fuksa (2013) similarly found a moderating effect of age on this relationship in the mobile internet use context. However, within the context of the online systems, Chang *et al.* (2019) result failed to support the moderating effect of age on the relationship between FC and BI to use online booking systems.

Additionally, Chang *et al.* (2019) found that FC does not influence the intention of users to adopt and use online booking systems for women compared to men. The findings are inconsistent with Binde and Fuksa (2013) study, which reported that gender affects the relationship between FC and BI. While several studies have reported on the moderating and supporting role of age in TAM and UTAUT, few and mixed results are reported for the

moderating role of gender in the relationship between FC and BI, while the effect of gamification adoption is yet to emerge. Based on the discussion, the following is hypothesized:

H4a: Gender and age moderate the relationship between facilitating conditions and behavioural intention.

4.5 SELF-DETERMINATION THEORY

The underlying research question guiding this study is: *How can gamification motivate and engage students in their basic psychological needs in a technology-enhanced learning environment?* Drawing on the research question, the study seeks to contribute to research on learners' engagement with gamification from the self-determination theory perspective.

A significant feature of gamification is user-generated content where the GIS becomes a "social learning platform" as students engage in discussion to create content (Kaplan & Haenlein, 2010). Users of GIS enjoy a high level of flexibility to determine which game design elements motivate (e.g. rewards or recognition) them, when to be notified for learning, when and how to achieve targets, what to create and share, and what assignment to take (Subhash, & Cudney, 2018). Before the emergence of digital games in education, the content of most learning management systems was designed and created by system administrators or instructors, and thus not social. In such instances, most users were unable to create discussion forums, comment, or add content to the platform. Users were primarily receivers of learning content – passive. Nowadays, users can create information and personalise their learning patterns to a level of engagement. Therefore, self-determination theory is arguably a salient aspect of game design elements in learning.

SDT highlights five types of motivation (correspond to regulation) that affect individual behaviours differently, namely 1) intrinsic regulation, 2) introjected regulation, 3) integrated regulation, 4) external regulation 5) amotivation (Deci & Ryan, 2008a; Vanskeenkiste *et al*.,

2009; Buckley & Doyle, 2014). Figure 4.3 shows the spectrum of motivation according to the tenants of SDT and indicates the extrinsic motivation dimensions.

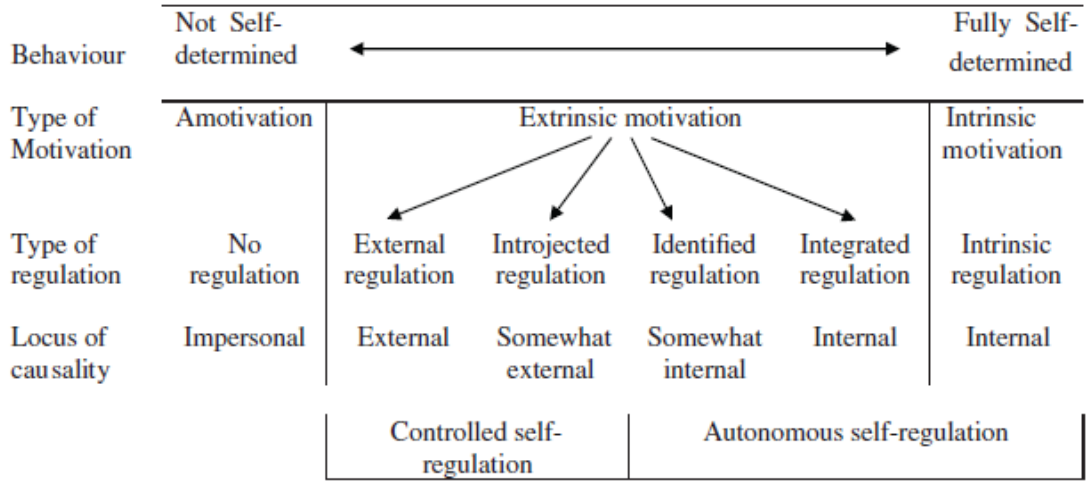


Figure 4.3 The spectrum of motivation according to SDT (Adapted from Deci & Ryan, 2000)

Aside amotivation (the least type of self-determined motivation), the four motivational types form a continuum based on the level to which regulations are *internalised*. The process of *Internalisation* refers to integrating the driving regulations with the sense of self, absorbing them and making them one's own (Deci & Ryan, 2004, p.1). Thus, internalisation relates to an individual's locus of causality (feeling of initiation of one's behaviour) through a process of a motivational continuum of self-regulation (Deci & Ryan, 2002). Deci and Ryan (1985; 2002) highlighted the importance of intrinsic motivation and referring to as doing something for fun or because it is optimally challenging and enjoyable.

Self-determined activities where satisfaction is inherent and engages people to act freely denote intrinsic motivation. SDT assumes that intrinsic motivation and identified regulation (self-determined) results in positive outcomes, while external regulation, amotivation, and introjected regulation (non-self-determined) may lead to adverse consequences. Thereby, SDT describes a set of psychological needs whose satisfaction is an intrinsically motivating source of action, which provides energy for individuals to act on their environment and manage their

behaviours in a *self-determining* fashion (Deci & Ryan, 1985, 1987). It suggests the need (psychological) for autonomy, competence, and social relatedness. Deci and Ryan argued that:

> *"It is part of the adaptive design of the human organism to engage in interesting activities, to exercise capacities, to pursue connectedness in social groups, and to integrate intrapsychic and interpersonal experiences into a relative unity" (p. 229).*

The following paragraph describes the three dimensions of self-determination theory applied to this study (i.e., self-determination or intrinsic motivation).

4.5.1 AUTONOMY, COMPETENCE AND RELATEDNESS IN EDUCATION RESEARCH

The need for *autonomy* is an individual psychological desire to make choices and have control over one's own life. It posits that one needs to act authentically in a consistent way with their true self (free choices) rather than volition (Deci & Ryan, 2002). For example, Khan Academy offers a series of lectures (paths) that can lead to the same outcome (acquiring a skill). This means that the user can make autonomous choices and have genuine desires and preferences rather than following a pre-determined path to complete a lecture or engage in an action that represents their true self (Deci & Ryan, 2000). The need for *competence* is the feeling of fulfilment after completing a task or assignment successfully. It defines the individual's psychological need (innate) to deal with the immediate environment effectively. Students' experiences through learning, adaptation, and exploration boost their competence – the accumulation of interactions with a system or environment (Deci & Ryan, 1995;2002). The need for *relatedness* describes the interactions, connections, belongingness, and deep concern regarding others through caring (Deci & Ryan, 2002). The innate individual psychological need involves receiving and providing care or love and the need for a mutual relationship (like-

minded) – experiences depending on interactions with others (Baumeister & Leary, 1995; Deci & Ryan, 2004; Richter *et al*., 2015).

Moreover, limited studies have examined the extent to which gamification elements support students' basic psychological needs in their pursuit to gain knowledge (Sailer *et al*., 2017; van Roy & Zaman, 2019). Van Roy and Zaman's (2019) studies found that game elements in learning arouse students' autonomous motivation as compared to controlled motivation. Sailer *et al*. (2017) found similar findings by integrating leaderboards, badges, and avatars in addressing students' psychological needs. However, Mekler *et al*. (2017) sought to address the psychological needs of users with PBL but did not observe the connection.

According to van Roy and Zaman (2015), situational factors may account for the mixed results as the situation, performance expectancy, and how students perceive gamification influence their experience with gamified IS. Thus, researchers have called for further studies to examine the success of game elements in supporting basic psychological needs and also the situation the students or users find themselves (Mekler *et al*., 2017; van Roy & Zaman, 2019). To this end, applying the SDT in the Ghanaian HEI confirms or contradicts the notion that specific game elements arouse students' basic psychological needs.

Prior research suggests that SDT is an appropriate theoretical perspective for addressing engagement and motivation in games and learning environments. However, these studies contain different and mixed results. For example, after integrating game design elements into students learning activities, Barata *et al*. (2013) found increased attention, participation, and attendance. However, a follow-up study showed that the attendance level of students reverted to its normal level. The game elements used in that study were badges and rankings (Barata *et al*., 2013). In another study, De-Marcos *et al*. (2014) reported a positive attitude among university students when game elements were integrated with their e-learning platform.

However, Dominguez *et al*. (2013) found increased motivation among students when no game elements were introduced to the same e-learning platform. It was also found that the best learning outcomes were associated with the students who used a non-gamified e-learning system during the semester, whereas those who were exposed to gamification performed better (De-Marcos *et al*., 2014; Dominguez *et al*., 2013).

A recent study by van Roy and Zaman (2019) represents success in the application of SDT in unravelling gamification potential in education. However, the authors did not explore the inter-relationships between the game elements of needs satisfaction, intrinsic motivation, and gamification in their study. Further, although they reported the ambivalent motivational power of gamification, they did not report on the mediating role of psychological needs satisfaction between game design elements and learning outcomes. To sum up the SDT tenability, it can be concluded that the results of Roy and Zaman are insufficient and limited. Hence, more research is needed to validate SDT in gamification in education.

4.5.2.1 CRITICISM OF THE SDT THEORY

Even though SDT is a prevalent motivational theory, it does not go without some criticism in education. First, motivational theorists have criticised the theory for including only a few constructs (three basic psychological needs), neglecting other motivational variables like engagement, growth and meaning (Miles, 2012). Also, they criticise the theory for its inadequacy to define need satisfaction and examine the conflicting role of the three basic needs. This study brings clarity to the definition and includes engagement in the research model to address critics' "Pollyannaish" view of SDT (Miles, 2012).

Second, the theory has been criticised based on cross-cultural generalisation. Critics argue whether motivational dynamics of self-determination apply to cultural values and especially to the students in other cultures (McInerney & Van Etten, 2004). The question arises whether

"autonomy is a universal psychological need" because Eastern cultures value social harmony and conformity. In contrast, different cultures emphasise autonomy, uniqueness, and individuality differently (Jang, Reeve, Ryan & Kim, 2009). Correspondingly, this study confirmed or falsified the cross-cultural generalisation of the constructs concerning the Ghanaian learning environments.

4.5.3 HYPOTHESIS DEVELOPMENT OF SDT

Trends in the use of gamified learning platforms indicate that until the advent of coronavirus disease in early 2020, the acceptance and use of these service platforms were considerably low over time and not well known (Suppan *et al.*, 2020). Limited literature has investigated the role of game design elements in self-determination and learning. The proposed conceptual model (Figure 4.3) integrates game design elements, need satisfaction (SDT model), intrinsic motivation (enjoyment) and an additional construct, learner engagement. This thesis is based on an integrated approach to examining learner engagement regarding GIS and learning platform services offered by instructors, wherein the students are less familiar with the technology and mode of teaching delivery. The conceptual framework is shown in Figure 4.3.1.

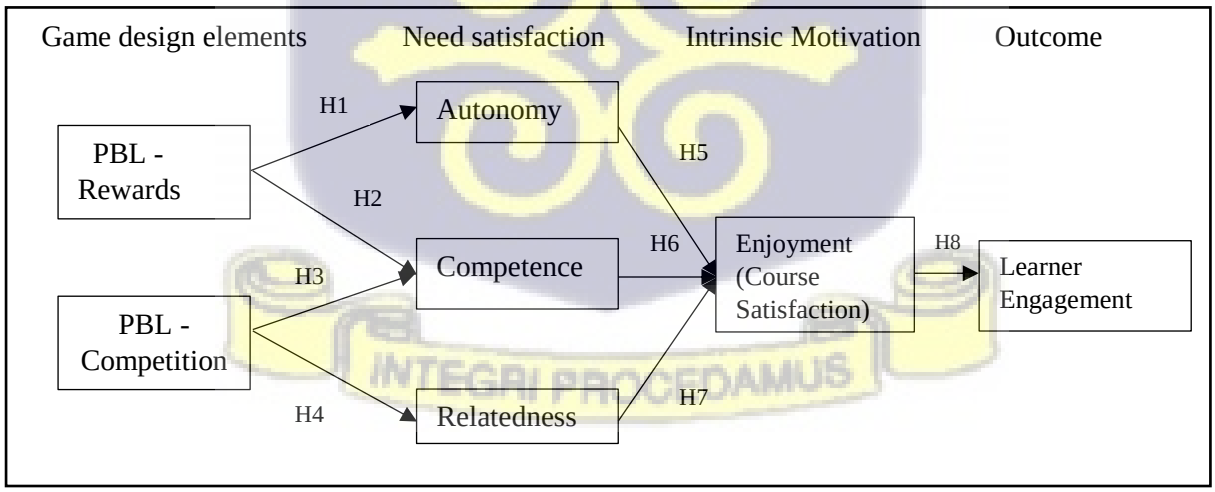


Figure 4.3.1 Conceptual Framework on Motivation and Engagement

Adopting appropriate game design elements has been an important question among educators, designers and practitioners (Liu *et al*., 2017). From an extensive review of the literature (Dellos, 2015; Wang, 2015; Göksün & Gürsoy, 2019), this study identified points, leaderboards, and badges as the main game design elements discussed in Section 2.3. These elements were selected because of the clear visibility it provides to players and the direct relationship this study expects to have with the theoretical perspective. Points serve as a reward and help measure player in-game behaviour by providing quick feedback (Sailer *et al*., 2013). They are mostly awarded upon the successful completion of assignments. Badges are a visual representation of accomplishments, and leaderboards are rankings based on points or scores of one's achievement.

It should be noted that the leaderboards may create social pressure among students when there is intense competition for the top spot, and this may increase system engagement (Burguillo, 2010). Unlike leaderboards, performance graph indicates student performance over time. Students improve when they see their graphical performance graph and display over some time.

Given the game elements identified, this study assumes that the need for autonomy, competence, and relatedness is associated with PBLs. PBL is referred to as a reward system or a form of competition in GIS. Thus, rewards are given to students as a payoff for completing assignments or tasks. It stimulates students to strive to attain high points, reach the top spot (leaderboards) and achieve trophies (badges) (Yang & Gong, 2021). It has also been shown that rewards enhance feedback and autonomy when students earn PBL. For example, points provide students with highly detailed feedback (granular), directly associated with students' actions and behaviours. Similarly, badges and leaderboards measure student actions over a given amount of time and provide cumulative feedback (Rigby & Ryan, 2011).

PBL provides choices over a task and flexibility over movement, thereby enhancing autonomy. For example, van Roy and Zaman found that students felt like free agents (i.e., deciding how often, when, and how) interacting with a gamified IS. Thus, they 'experienced the challenges as voluntary exercise' in their preparation for exams. Accordingly, PBLs are designed to provide feedback that reflects user system preferences (Ryan, Rigby & Przbylski, 2006) and what the users intend (choice) to do with PBLs in a gamified application (Werbach & Hunter, 2012), resulting in an increased autonomy perception.

This study posits that relationship formation, self-presentation, interactivity and sharing of learning materials and contents can help learners realise the need for autonomy and enable them to freely choose what to present (Kaplan & Haenlein 2010). Besides, they provide the learners with practice quizzes to engage in and with learning content to choose and share and allow them to listen to or read whatever they choose and freely interact with their online gamified environments (Karahanna, Xu, Xu, & Zhang, 2018). For example, the gamified application provides learners with *self-presentation, relationship building – (communicating with similar learners during a course), sharing of learning contents and connection with family (family fun),* which allows them to present themselves in the way they prefer or to choose what research topic to browse (e.g. sharing courses, pictures or interesting articles, updating their profile picture and even disclosing their university of affiliation or programme of study). Importantly, game elements that afford interactivity and self-presentation allow learners to choose avatars, customise their profile display, work hard or build more points if they want to be ranked higher on the leaderboards, interact with co-learners and participate in learning behaviours that reflect their true identity without being perturbed about norms that constrain their behaviours as in a real-life context (Kaplan & Haenlein, 2010; Sailer & Sailer, 2021). Moreover, distance learning and self-study affordances, for example, on a gamified platform

allow learners to choose 'competitive ranked courses or group' or challenging quizzes that they join or solve. This discussion, hence, leads to the following hypothesis:

H1: Points, badges, and leaderboards (PBL) as rewards influence autonomy need satisfaction in gamified IS.

Several game design elements are perceived as motivational drivers that engage user activities on gamification platforms. Thus, game design elements that provide students with granular or cumulative feedback on their performance or work should arouse feelings of competence (Sailer *et al*., 2017). To feel competent is to have the ability to alter or effectively control one's learning environment and search for a means to maintain or acquire new skills, capabilities and knowledge (Moffitt, Padgett, & Grieve, 2020). Therefore, students passionate about competence seek opportunities that expand their knowledge, learning and capabilities in their educational setting. This study suggests that online group learning, competition and collaboration in gamified environments help students realise the need for competence by enabling them to hone and apply their skills. This is achieved by participating in class quizzes, engaging in platform discussion, responding to colleagues' questions or providing feedback, competing for the topmost game design elements (e.g. points, badges or leaderboards) or collaborating to create learning content for the class (Alghamdi, Karpinski, Lepp, & Barkley, 2020).

For example, in gamification learning applications, learners can gain further insights and apply their knowledge on a topic by creating content specific to their course of study or engage in-class quizzes or discussions mediated by their course instructor or the administrator of the platform discussion (Göksün & Gürsoy, 2019). In a gamified environment, in which competition is salient, a challenge can emerge among players, that is even rare in real life, hence providing the learners with a unique, enjoyable learning opportunity to demonstrate their

effectance and efficacy and their challenge (Xu *et al*., 2013; Karahanna *et al*., 2018). GIS for example, provide learners with an opportunity to challenge and complete semester courses within a time frame. They allow them to experience competence through quizzes and solving practical questions via video-based learning to demonstrate their expertise in the course (Wang & Tahir, 2020). Such application supports the need for collaboration among learners (ie. discussing a research topic, satisfying colleagues' online needs, or joining class groupings to conquer challenges for game points) and improves their competencies. This discussion, hence, leads to the following hypothesis:

H2: Points, badges, and leaderboards (PBL) as rewards influence competence need satisfaction in gamified IS.

This study also expects PBL to evoke some level of competition among students. As stated earlier, students who want to receive rewards might have to put in extra effort to reach the top of the leaderboard and receive a trophy (badge). Therefore, the leaderboard is considered fundamental for displaying the results (accumulation of points) and revelling the class's front-runners. Thus, the central aim of engaging in a game is to compete for the ultimate goal. Through competition, students experience the feeling of interaction and relatedness with others. Competition also reflects the asymmetries in the skill endowment of individuals in games and propels one to achieve more in a competitive environment (Ryan & Deci, 2000). Such interaction may allow a player to internalise the competencies of others, thereby improving their position within a gamified system. Hence, the following hypothesis is made:

H3: Points, badges, and leaderboards (PBL) as competition influences competence need satisfaction in gamified IS.

This thesis argues that a set of game design elements – *points, badges and leaderboards* – can help learners realise the need for social relatedness by opening up broader social connections

in a gamified environment (Majchrzak & Malhotra, 2013). The gamified application achieves this by connecting players with a collective 'aim' online status, enabling the participation of learners in a group activity (Nambisan *et al*., 2017) and indicating players that are available for learning interaction: *some can be online but not in available learning mode.* It also helps learners know which course their colleagues are completing or partaking in most, who they are collaborating with within a course and their reaction to a post and comments in a social setting (Majchrzak & Malhotra, 2013). For example, in a gamified application, learners can establish social connections with unknown learners or befriend others according to mutual course completion or leaderboard rankings; thus, *users can see the best performing learners on the leaderboard whom they have no mutual connection with (*Aryani, Bablan, Moeinikia, & Khaleghkhah, 2020).

GIS allow players to join groups to accomplish tasks or assignments, form relationships, make new friends, share their adventures and interact with players whom they might never meet in person (Stopfer, Egloff, Nestler, & Back, 2014). Game design elements help increase the intensity of social interaction that students have with other learners. Social interaction can satisfy the need for relatedness when the frequency of interaction increases through game design elements, and it can create engagement in platform discussions response to others, self-presentation and communication which yield a feeling of relatedness due to increased familiarity (constant interaction) (Karahanna *et al*., 2018). For example, using gamified learning, teachers can engage students outside the classroom using challenge design elements, and learners can also host a live game over a video that can be shared to receive likes, comments and messages. The features produced by game elements allow for instantaneous social interaction, which promotes social belonging and bonds among the course learners (Marlow, Dabbish, & Herbsleb, 2013). This discussion, hence, leads to the following hypothesis:

H4: Points, badges, and leaderboards (PBL) as competition influences relatedness (social) need satisfaction in gamified IS.

From the psychological need perspective, individual self-determination or motivation is mediated when basic needs are satisfied (Deci & Ryan, 2008b). In the context of education, need support has been shown to provide students with a better understanding of course materials, better grades, and more autonomous motivation (Ryan & Deci, 2009).

Several empirical studies have supported the mediating effect of user satisfaction. For example, Shen, Liu, and Wang (2013) found that elementary school students' perceived online need satisfaction predicts their high-level use of the internet. In contrast, their perception of need satisfaction in real life predicts a positive effect (growing interest) and less time engaging in online activities. Therefore, need satisfaction resulted in the prediction of intrinsic motivation, which in this study is course satisfaction. Thence, the following hypothesis is made:

H4: Need satisfaction influences intrinsic motivation/course satisfaction in the gamified IS.

SDT assumes that self-determined behaviours lead to positive outcomes and that non-self-determined behaviours result in negative outcomes. Several studies have posited that students with higher self-determination have a positive learning engagement and turn to achieve better learning outcomes than those with low self-determination (DomíNguez *et al*., 2013; De Marcos *et al*., 2014). Further, in a series of gamified learning activities among students, Su and Cheng (2015) found a positive relationship between self-determination and learning achievement. Additionally, SDT proposes that if users perceive an online activity or game to be more satisfactory and motivating towards a task, they anticipate engaging more extensively with the technology (Chen *et al*., 2015; Wang & Li, 2016). Given that game research has shown that gamifying activities are very motivating and enjoyable, self-determination/intrinsic motivation

is a central factor in determining students' engagement with gamification applications. Engagement is evident when players derive motivation and satisfaction from interacting with game design elements. This can drive the students to pay attention and increase their interest in learning course materials. The following hypothesis is, therefore, made:

H5: Course satisfaction influences learning engagement (learning outcome) with gamified IS.

4.6 MOTIVATION-OPPORTUNITY-ABILITY THEORY

The Motivation Opportunity Ability (MOA) theory plays a vital role in understanding human behaviour change and task performance, particularly applying all three factors (motivation, opportunity, and ability) are antecedents to action and interrelated behaviour (Maclnnis *et al*., 1991). The M-O-A combination is the widely used format even though across different fields the direction of the letters (acronym) is interchangeably used. The framework assumes that, for any occurrence or non-occurrence of behaviour, the learner is affected by the characteristics (motivation, abilities) and the external environment (opportunities).

4.6.1 MOA CONSTRUCTS

Motivation is a force that stimulates learners toward perceived outcomes and involves factors such as willingness, interest, readiness, and desire (Lai, Hsiao & Hsieh, 2018) and has a strong *self-interest* component (Rothschild, 1999). The factors set the individual or institution up for action if they know the end benefit; hence, they put in the right effort. *Opportunity* characterises the degree to which an attributable benefit of acting toward a specific goal is visible. The learner's will may be present, but the means to attain the goal may not; hence, it is essential to recognise the learner's conducive environment. Opportunity in this study is attributed to the contextual factors that are conducive to achieving a specific action. *Ability* is the learner's knowledge, skills, and attitude to achieve the desired

outcome and is affected by resource constraints. According to Siemsen *et al*. (2008), MOA is related to constructs that are mutually reinforcing intrinsic behaviours. For instance, from the perspective of I/S efficacy, students who are less likely (ability) to use a GIS may also be less motivated to do so because they may perceive that the use or continuance-use will be difficult or experience less likelihood of success in attaining the goal. Also, the feeling that they may not be able to contribute to other students learning success demotivates them (Gist & Mitchell, 1992). In line with Siemsen *et al*. (2008), this study conceptualises the MOA framework as correlated but distinct concepts because the precise direction of all causal relationships among MOA is challenging to justify theoretically.

In organisation behaviour, the framework has been extensively applied, unlike in the IS field. The lack of research focus in IS literature may be due to the unresolved relationship between MOA factors and the operationalisation challenges of the concept (motivation, opportunity, and ability). While gamification is an infant research area, motivation has played a critical role in predicting continuance use (CU). However, the effect of game elements on opportunity and ability is inconsistent in IS literature across gamification research (Nicholson, 2012). This implies that motivation could mediate opportunity and ability, while ability and opportunity could indirectly affect CU. The thesis responds to literature by drawing on the MOA framework to examine specific factors that constitute opportunity, ability and motivation to continue using gamification in education in a student environment in HEI. As discussed in the next chapter (research framework), the study focused on learner aesthetic experience for CU and aligns with motivation, perceived IT capability as ability and information quality as opportunity factors. The MOA framework is employed to drive the effects of these factors on CU. The three main constructs of MOA are further explained in the hypothesis development Section 4.6.3.

4.6.2 APPLICATION OF MOA TO EDUCATION RESEARCH

The MOA framework has been widely applied in knowledge management activities and information sharing (Siemsen *et al.*, 2008; Kettinger *et al.*, 2015). Other studies have conceptualised the MOA framework in learning behaviours and team formation (Lai & Hsieh, 2016). However, the potential of the framework to predict learning outcomes with games has not been explored yet or extended to gamification research. Also, the factors that explain the challenges and prospects in appreciating gamification strategies in HEIs in DE have not been examined. In this regard, Scott and Davis (2015) highlight that I/S are not the only context influencing the activities of individuals. There are other influencing factors typical in developing economies. Given that individuals identify opportunities that are readily available to them through a motivated self-interest, their abilities to attain the goals may vary. Thus, to ensure functional equivalence and examine the predictive power of the constructs (Bastl *et al.*, 2013), the application of the MOA framework in this study is approached from an individual-level perspective.

4.6.2.1 CRITICISM OF MOA THEORY

Although the MOA was tested at the individual level of processing information, recent studies are yet to analyse the phenomenon at both the individual and group-level. Thus, critics have argued for an explication of the theory to examine both levels of analysis, as the theory is more aligned to individual-level analysis (Hughes, 2007). Also, the scholars have maintained a confirmation of the M-O-A nomothetic network, especially in developed economies. However, some researchers feel the need for further investigation and critical evaluation of the network in developing economies (Raja & Frandsen, 2017). To ensure the theory's strength and generalisability, this study seeks to apply the theory in Ghana, a DE context to fend off criticism.

4.6.3 HYPOTHESIS DEVELOPMENT OF MOA THEORY

The underlying research question guiding this study (framework one) is: *How does a learner's aesthetic experience (motivation), information technology capabilities (abilities), and information quality (opportunity) integrate and contribute to continuance use (CU) of gamification?* Drawing upon the research question, the study seeks to contribute to research on learners' CU of GIS in threefold: First, is to predict learners' CU of a GIS by proposing a theoretical model based on MOA framework and conceptualising aesthetic experience (AE), information technology capabilities (ITC) and information quality (IQ) in the context of the MOA framework. Second, five hypotheses are developed for testing. Third, due to the interesting nature of the variables and the fact that it has not been in GIS, the study examines the mediating roles of aesthetic experience, information technology capability and information quality (IQ) in predicting continuance use (CU) of gamified information systems. The following sections detail the hypothesis development for this study.

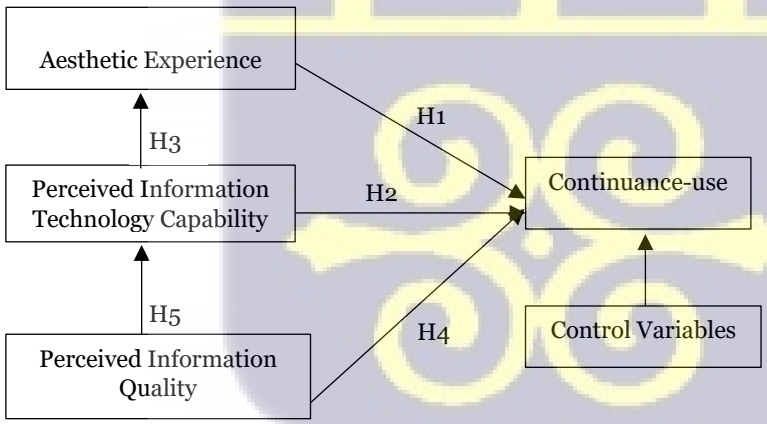


Figure 4.4 Conceptual Framework[2] on Continuance Use

[2] *NB. Notwithstanding the uniqueness of this model in the gamified IS context, the model has the potential to hold in the non-technological context. This is because gamification is about design thinking and not necessarily the technology but rather the approaches used to engage players to the desired outcome (learning goals). Gamification, therefore, is not limited to a technological medium or to be hosted on digital platforms. It is essential to stress technology as an enabler and not necessarily the prerequisite for gamification.*

4.6.3.1 Aesthetic Experience as a Motivation

Aesthetic is considered the "science of how things are known via the senses" and relates to the appreciation of beauty, art, or taste (Jiang *et al.*, 2016 main ref). The appreciation of beauty, also known as aesthetic experience, provides a meaningful background for connecting the learner's interest, behaviour, and motivation in a gamified environment. While the concept of AE has been established in the arts and philosophy fields, its underlying scientific assumptions for engaging users with IS have been reported in several studies, such as game-based learning, video games and game studies; marketing and tourism (Xu *et al*., 2013) and human-computer interaction. In line with HCI, D'olimpio (2021) contends that for an institution to maintain effective management learning practices, the AE of users should be considered to foster a task-related activity that generates meaning. These various studies recognise AE as essential for HCIs, and it connotes the individual state of mind and how he or she interacts (understands) with the IS (Liu *et al*., 2017).

The concept of motivation has been widely studied in gameplay and can provide insights into motives for users' aesthetic experiences and engagement. Motivation can be explained in two main types or tailored to a specific context: intrinsic and extrinsic (Ryan & Deci, 2000). Intrinsic motivation are behaviours driven by internal rewards (pleasure generated by the activity), while extrinsic motivation is regulated by external factors (perform an activity to attain an external outcome). In gamification research, scholars prioritise tailored approaches to include motivational affordances, fitting the aesthetic experience context under investigation (Suh *et al*., 2018). Following this prioritisation, this thesis conceptualised the aesthetic experience in the CU context and develops a new construct CU– AE to inform the measurement items. AE in this context represents the learner's perception of the artefactual motivational factors such as rewards, status, and competition in the GIS about CU. The researcher, therefore, defines CU-AE *as the continuous use representation of aesthetic experience with the GIS.* As

an intra-learner factor and a perceptual mediator, the AE affects the individual learner and the situational motivational factors (voluntariness and goal alignment) in the learning environment (Deterding, 2011). Consistent with the literature on aesthetic experience, the study expects AE to have an impact on the learner's CU behaviour.

The extent to which users perceive a specific aesthetic needs to be considered when evaluating and improving their motivation and engagement. Through an extensive literature review, the study identified four key dimensions (rewards, competition, self-expansion and meaning) of AE (Suh *et al*., 2018). As a result, the dimensions highlight how aesthetic experience leads to continuance use intention which intends fulfil engagement and desires. Rewards refer to incentives provided to users for successful task completion. From an educational perspective, the GIS compensates and encourages students' meaningful engagement with their colleagues, and instructor, and promotes continued usage. The higher the rewards in the gamified IS, the higher the level of engagement and use (Suh *et al*., 2017).

Additionally, the elements compensate for and encourage learners' efforts to share their knowledge and experiences with colleagues. Competition refers to the extent to which users compare their performance to others in the gamified IS and attempt to better others' performance. Learning to compete enables students to learn from themselves and strengthen their connection to a collaborative activity (Nardi, 2010). Leaderboards, points, and levels are the main game elements that offer opportunities for competition (Deterding *et al*., 2011). Research suggests that competition leads to CU in gaming because the suspense of the unknown outcome propels the player to compete in an immersed way (Santhanam *et al*., 2016). Self-expansion refers to the extent to which an individual's sense expands by broadening his or her perspective or getting to know or perceive things (Jennings, 2000), thereby experiencing self-growth. From a motivational perspective, self-expansion has the potential to impact

perceptions of a CU environment positively. The self-expansion model postulates that an individual is motivated to grow and improve the self by enhancing capabilities, increasing interest and engagement in activities, and attaining new identities (Aron *et al.*, 2013). Finally, meaning is the extent to which individuals derive an understanding of the meaning of activity in an engaged and more productive way (Mattingly & Lewandowski, 2013). Students who proactively seek out and apply meaning to tasks are considered the most productive in learning (Faraj, Jarvenpaa, & Majchrzak,2011; Ma & Agarwal, 2007).

Gamification researchers suggest that relatedness and closeness of fit between personal goals and the goals specified by the GIS encourage continuous use and may increase use behaviour. This view suggests that learners' perceptions of gamified courses and the educational environment drive behaviour and create normative belief systems. For example, timely feedback to students in a gamified IS improves engagement, provides real-time notification, and makes it easy to monitor students' progress. Therefore, the study hypothesises the direct impact of students' AE on GIS use:

H1. Aesthetic experience (AE) influences continuance-use (CU) of gamified IS.

4.6.3.2 Perceived Information Technology Capability as Ability

With a growing focus on hedonic experiences (Deterding *et al.*, 2011; Davis *et al.*, 1992) in ensuring technology continuance, emphasis on the ability of users to possess the required skills is important. In the context of CU, ability is the skill and proficiency (Siemen *et al.*, 2008) required by the students to use the gamified IS for various tasks assigned. The study proposes that perceived information technology capability (ITC) (Panda & Rath, 2021) represent the knowledge and skills of the students in the gamified IS. The perceived ITC focused on the individual capabilities and competence for navigating and managing the system and task, including: "technical, behavioural and business capabilities" (King, 2003; Fink & Neumann,

2007). Although the original ITC was conceptualised at the organisational level, the core tenant of ITC constructs is related to the individual level, i.e., the student. Prior research suggests that students require a blend of technical, behavioural and business capabilities to thrive in the innovative and learning environment and effectively serve their institutions (Lee *et al*., 1995; Fink & Neumann, 2007). Specifically, technical capability relates to the IT student's technical knowledge and skills based on the gamified IS in education. Behavioural capability includes the interpersonal skills that encourage interactions with the system and among students. Business capability (IT personnel's knowledge of the overall business environment), which is conceptualised as educational capability, aims to advance our knowledge of gamified IS in an educational context. Educational capability encompasses the IT student's knowledge of the gamified IS (i.e., educational institution) and specific curriculum context. While the technical, behavioural, and educational capability taps into different features of capabilities required for information technology, they are not unrelated. As learning is a continuous process that requires seamless integration of all the capabilities in the IS, the three capabilities are interdependent and form an intra-individual information technology capability measure.

Ability, as captured by ITC, is essential to CU for two reasons. First, it reflects a deeply involved user state and engagement with the gamified IS (Hamari & Koivisto, 2014). Second, it provides evidence of repeated use and enhances continuance intention. Information systems research suggests that processing, retrieving, and storing information accurately facilitate systems continuance-use and meaningful engagement among students (Liu *et al*., 2017). Ease in navigating (technical) assignments and tasks in an IS can positively impact students' use behaviour, enrich their IT skills, and encourage group learning and information sharing. Thus, technical capability is essential because it permits students to identify, integrate, and utilise technical elements in retrieving and processing information in the gamified IS. In applying new technologies and effectively integrating new systems with old ones, technical knowledge and

skills are essential for the students (Ross *et al*., 1996; Fink, 2011). Additionally, for effective management of gamified IS, students require a behavioural capability to meet the dramatic increasing nature of educational processes and procedures. An important task in educational capability is the student's ability to utilise game elements in learning systems in a manner that meets educational or curriculum objectives (Strong *et al*., 1997).

Further, previous studies have shown that students with higher motivation acquired through IT capabilities and self-efficacy perceive themselves as more competent than those who do not have the skills (Leung, 2011). In the areas of motivation, behaviours, and expectations, perception of competence and skills have been one of the underlying determinants of success in education (Hamari *et al*., 2016). Since individuals value success as a positive feeling and failure as a negative, by nature, people are prone to motivational and engagement factors that yield a feeling of competence and capability. These motivational feelings of competence are fundamental to learning and contribute to continued motivation, resulting in continuous use behaviours (Jeno *et al*., 2019). To this end, as a function of incompetence towards system use, many students will feel uncomfortable to harness the motivational powers of gamification, which will lead to increased competence, accept new challenges or practice assignments that might increase continuous use behaviours. Finally, the success of new educational initiatives often depends on the institutions having the necessary IT infrastructure capabilities in place, and keeping information up to date for the effectiveness of CU. The above reasoning capabilities are interrelated and together constitute a student's ability to use the GIS. Therefore, the study hypothesises that:

H2: Perceived information technology capability influences continuance-use (CU) of a gamified IS.

The study also expects a direct association between perceived ITC and AE, which serves as the mediating role of AE. Simply adopting and implementing aesthetic gamification for teaching and learning is insufficient to create a CU environment and to encourage and support innovation. Thus, educators and students have to learn how to apply classroom practices to technology effectively while they are implementing gamification. In this regard, individuals' judgement of their capabilities to execute a task or function is fundamental to their environmental existence. The literature on use behaviour describes IS continuance as a hypothetical construct that explains the causal link between variables. The point of a causal link is in the individual and intervenes between artefact, environment, and individual qualities (Deterding, 2011). Since the perception of the environment is different from individuals (e.g. goal alignment), the procedures and processes one performs to achieve engagement with the IS have a direct impact on aesthetic experience (Norman, 2004). In the context of CU, these findings suggest that AE is a causal variable (intermediate) between individual qualities such as perceived ITC and CU actions. According to Tanriverdi (2005), learners ' IT functions as a significant resource to enhance relatedness, cross-unit learning capabilities, and a sense of belonging to one's educational environment. This acquaints the learner with valuable information on the syllabus and course discussions on the gamified platform to improve classroom awareness. Therefore, the study posits the intermediary role of AE between ITC and CU activity and hypothesises that:

H3: Perceived information technology capability (ITC) influences aesthetic experience (AE).

4.6.3.3 Perceived Information Quality as an Opportunity

Over the last decade, there has been considerable interest in the quality of information in platform feeds. Concerns about poor information were redoubled in 2020 in the face of

widespread disinformation and misinformation on various platform feeds about the novel coronavirus disease (Covid-19) pandemic. Students and academics face similar issues and require accurate information in their studies when using open and social in gamified IS. Therefore, the quality of information has become an important fabric of many higher education learning information systems.

Poor information quality dispels efforts and strongly influences decision quality, which can impede students' output and damage the institution's reputation and ranking (Gorla *et al.*, 2010). DeLone and McLean (1992) relate the outputs the information system produces to information quality, which can be in the form of online screens, feeds, or reports. Many factors influence information quality. However, this study finds the validated constructs of Wixom and Todd (2005) as success variables applicable in the education context. To this end, the study arrived at four dimensions based on Wixom and Todd's (2005) measurement – completeness, format, accuracy, and currency. These variables influence LMS and can provide information and satisfaction to the target audience (Wixom & Todd, 2005). Completeness refers to all the necessary information provided by the system; accuracy represents the correctness of the information as perceived by the user; format is how well the information is presented to users, and currency represents up-to-date or recent information presented to the user by the gamified IS. The four dimensions determine the student's perception of the quality of the information provided by the gamified IS. The information quality scale items are listed in Appendix A.

Prior research suggests that providing students and educational institutions with quality information from multi-dimensional perspectives serves as an opportunity to help them devise strategies to drive effective information improvement and continuous behaviours (Salam & Farooq, 2020). The potential objective of these strategies is to change students learning processes and the structure of educational institutions in harnessing IS in education. The results

of these strategies, if implemented correctly, can better enable higher education institutions to improve their performance and coordinate their activities to produce substantial educational, technical, and curriculum benefits (Janssen *et al*., 2012). To develop a gamified IS with effective information quality improvement strategies, it is essential to explore the relationships between the cause (information quality) and effect (educational benefits and performance).

Further, IS research investigating and analysing the significance of motivational information systems (gamification) and information highlights *quality* in terms of rigour and relevance in IS (Koivisto & Hamari, 2019). Nevertheless, in the context of GIS, limited research is conducted on information quality. Additionally, the literature on the success of gamification has rarely examined information system and information quality contributions to the potential of GIS (Suh *et al*., 2017; Setia *et al*., 2013). Also, the linkage between GIS value in educational institutions and information quality has been minimally examined and less grounded theoretically (Kankanhalli *et al*., 2012; Yang & Wu, 2014). Notwithstanding the potential of gamification to improve learning, motivate students, and enhance the quality of teaching delivery, GIS initiatives in education face changes in development. Thus, an educational institution that prioritises information quality of GIS can reduce perceived external and internal barriers such as non-recurrence, physical distance, and task congruence to CU. By reducing perceived barriers, IQ can increase the continuance-use of the system and influence CU activities. Based on these arguments, the study proposes a positive relationship between IQ of the gamified IS and CU and proposes that:

H4: The perceived information quality within the gamified IS influences the student's continuance-use (CU).

Building students' ITC entails greater strategic coordination in the IS. When students perceive the quality of information as part of their syllabus, they are motivated to acquire the necessary

skills and ability to access the information. In particular, when it is a requirement to access course materials, take quizzes, and contribute to discussions on the IS platform. Without adequate perceived IQ for the primary ITC, the information mishandling can result in less meaningful engagement with the IS and poor performance.

On the other hand, the perceived quality of information through collaborative learning can change behaviours in sequence and may restrict or enhance the functions of IT capabilities (Bélanger & Allport, 2008). Prior research has found that information quality influences numerous outcomes, such as trust and engagement (Wu & Liu, 2007), IT adoption (Kim & Han, 2011), user satisfaction, loyalty and knowledge-sharing behaviour (Hsu, Ju, Yen & Chang, 2007). The study, therefore, proposes the importance of information quality in the digital technology strategy and design of GIS (Wixom & Todd, 2005).

H5: Perceived information quality (IQ) influences perceived information technology capability (ITC).

4.6.3.4 Control Variables

Control variables are used to describe the variance in the dependent variable other than factors that account for the theoretical interest of constructs (Ravichandran *et al.*, 2005). In this study, individual-level factors such as age, gender, level of study, and mode of study may influence continuance-use and are used as control variables. These factors have been applied in previous studies on gamification (see Turkay *et al.*, 2014).

Further, educational psychologists have noted that older students attach more importance to receiving academic assistance and help in completing assignments (e.g. Chong, Martinsons & Wong, 2004). Given the increasing physical and cognitive limitations associated with age, it is important to highlight the context of complex IT use in an educational environment. These arguments are consistent with the empirical results from Morris and Venkatesh's (2000)

findings. Thus, when moderated by age, mode of study, level of study, and facilitating conditions *(see Section 4.4.3.3 for further explanation)* will significantly influence gamification use behaviour.

4.5 CHAPTER SUMMARY

This chapter presented the three theories underlying this study: Unified Theory of Acceptance and Use of Technology, Self-Determination Theory, and Motivation-Opportunity-Ability theory. In this chapter, I highlighted the theories antecedents, its application to this study, relevance, and criticism levelled against it. Based on the drawbacks of the UTAUT, SDT and MOA theory and the need to fill the research gaps, I proposed three conceptual frameworks.

Further, the chapter established the relationship between the variables in three models. The first model includes seven hypotheses to be tested: the relationship between behavioural intention to use gamification in learning and performance expectancy (H1), effort expectancy (H2), attitude (H3), facilitating conditions (H4), trust (H6), and social influence (H7 image (H5). The second model highlights eight hypotheses for examining engagement with game elements. The primary constructs include dynamics evoked by game design elements, need satisfaction, intrinsic motivation, satisfaction, and engagement. The third model includes five main hypotheses: the association between aesthetic experience, information technology capability, information quality, and continuance use of gamification. The other two associations are between information quality and perceived information technology capability and perceived information technology capability and aesthetic experience. Subsequently, the controlled variables used are gender, age, level of study, and mode of study.

CHAPTER FIVE

RESEARCH METHODOLOGY

5.1 CHAPTER OVERVIEW

In the previous chapter, I reviewed the UTAUT, SDT and MOA theories underpinning this thesis and proposed the conceptual frameworks. In this chapter, I discuss the quantitative methodology used in this dissertation. It consists of the research paradigm, assumptions, research method, and research design. This is followed by explaining the methods of collecting data and conducting the analysis – i.e. assessment of the measurement model, structural model assessment and predictive relevance.

5.2 RESEARCH PARADIGM AND PHILOSOPHY

The IS field has been classified as multi-disciplinary. Several disciplines add to examining the implementation and use of I/S in organisations. Due to its multiplicity as a discipline, there are different paradigms to study a particular phenomenon. A research paradigm is a set of beliefs, values, and techniques which members of a scientific community share (Kuhn, 1970). There are three dimensions to a paradigm: ontological, epistemological, and methodological assumptions (Guba & Lincoln, 1994). The ontology defines the form and nature of reality; epistemology looks at the relationship between the researcher and what can be generated (known), and the methodology refers to how the study is conducted (framework) either from a quantitative, qualitative or mixed-method approach (Guba & Lincoln, 1994; Lincoln, Lynham & Guba, 2011). Many paradigms exist to guide research. The three dominant paradigms include positivism, interpretivism, and critical realism (Orlikowski & Baroudi, 1991).

5.2.1 Positivism

The most dominant research perspective in IS is positivist research (Pinsonneault & Kraemer, 1993). The positivist view about physical and social reality is objective and independent of the subject. Primarily, the positivists understand phenomena through appropriate constructs formation, designing a set of instruments to capture the nature of the events, through modelling and measurement of the problem (Guba & Lincoln, 1994). During the investigation, the researcher detaches (validity of the study is threatened when there is a reduction in independence) himself from the phenomenon of the study and assumes a passive and neutral role (Sarker & Lee, 1989). For instance, a researcher investigating behaviour change in GIS may assume that the system is objective and capable of being characterised by the constructs devised by the researcher, such as classroom practices, and span of control.

Concerning the beliefs about knowledge, the positivist is interested in empirically testing a theory; also referred to as the hypothetical deduction justification of scientific account (Guba & Lincoln, 1994). Accordingly, positivists employ the deductive approach to discover causal relationships, make generalised knowledge of a phenomenon, and predict behavioural patterns across conditions. Similarly, approaching research with a known premise and principle enables predictive behaviours or control of the action.

Methodologically, positivist employed a general theory to generate a proposition, test the hypothesis and quantitatively measure the variables. Importantly, positivist researchers draw conclusions about a phenomenon of study from a sample (Orlikowski & Baroudi, 1991).

5.2.2 Interpretivism

Interpretivism holds that reality is socially constructed and multiple realities exist (Walsham, 2006). To understand the subjective meanings and individual actions, the interpretivist goes beyond the observable actions in their social phenomenon, thereby interpreting the reasons

behind those actions (Walsham, 2006). Interpretivist aim is to understand the context of IS and how the IS influences the context and vice versa. Primarily, the underlying research approach by the interpretivist has been the inductive approach (Myers, 2013; Creswell, 2013). The inductive approach reveals the type of data to collect and the patterns that emerge from the analysis are recorded to identify the relationship between variables.

5.2.3 Critical Realism

Critical Realism assumes the historical construction of social reality; however, individuals can produce and reproduce them. To the critical researchers, various factors such as cultural, social, or political issues account for people's inability to change their circumstances. Similar to the mixed-method approach, critical realism positions itself between positivism and interpretivism. For critical realism, there is a real world that exists independently of our knowledge about it, although multiple interpretations of it may exist (Klecun *et al.*, 2014). Thus, knowledge is grounded in historical and social practices. They suggest that historical data is fundamental in challenging the status quo. Investigations about a phenomenon are carried out using the retroduction process. The retroduction process begins with empirical observation and reaches the conceptual and transfactual conditions of events (Easton, 2010).

The ***choice of a research paradigm*** is based on my philosophical views of the world, the skills I have developed in terms of methodological approaches, my level of knowledge about the research topic and interest in quantitative analysis (Krauss, 2005). That said, my philosophical view about the world and how knowledge is known and constructed influenced the choice of paradigm. The researcher's view of the world is positivism, and this is in agreement with Guba and Lincoln (1994) that the positivists understand phenomena through appropriate constructs formation, designing a set of instruments to capture the nature of the events and modelling and measurement of the problem. Consequently, concerning the research purpose, the study aims

to develop a theoretical and practical understanding of gamification antecedents and the outcome of adding game elements to learning in HEI. Additionally, the study hypothesises game elements influence on users' psychological needs perspective, aesthetic experience, information technology capability and quality and their post-adoption behaviours.

Second, positive research through quantitative means has been used to explore research topics where the level of knowledge is yet to gain maturity (Hamari *et al*., 2014). Gamification is a relatively new topic that commenced in 2008 and has yet to gain popularity and maturity in developing economies. As such, it has enjoyed a few numbers of literature reviews and philosophical debates (Kovisto & Hamari, 2019). Notwithstanding its infancy, gamification research has been applied to a wide variety of applications and disciplines. In recognising its dynamic concept, the researcher has defined appropriate research questions and objectives that can be addressed within the positivist research approach. Additionally, a quantitative approach that involves multivariate analytical techniques is selected to address the research purpose and questions. Structural Equation Modelling, a form of multivariate technique enables researchers to examine the relationship between a "*single metric dependent variable and two or more metric independent variables*" by hypothesising and constructing models that constitute a testing phenomenon. These techniques are well utilised and embraced by positivist research. As with interpretivism and critical realism, the positivist is focused on testing theories - propositions, measuring variables quantitatively, testing hypotheses, and concluding a phenomenon of a population sample. Consequently, the above argument informed the researcher's choice and application of the positivist research paradigm in this thesis.

5.3 RESEARCH APPROACH

To unearth the motivational powers of games in education, the positivist adopted several research approaches (Sarker & Lee, 2000). The first is the deductive research approach, which

deals with developing a hypothesis based on existing theory and then designing a research strategy to test the hypothesis (Shanks & Parr, 2003). The purist hypothetico-deductive perspective employed a general theory that tests for validity in a given phenomenon. Generally, the deductive approach formulates a hypothesis for testing. In contrast, the inductive approach does not form a hypothesis in the research process. Thus, the deduction begins with a predictable pattern that is tested against observations, whereas induction starts with observations and seeks to find a pattern within them.

This study employed the deductive approach for two main reasons: 1) to test existing theories in gamification research and 2) to investigate the determinants of continued use behaviour of students in a technology-mediated environment. UTAUT, SDT and MOA are the theories underlying the study, out of which propositions were formed for hypothesis deduction.

Second, positivist research employed descriptive, exploratory, or explanatory research methods to study their research objectives or purpose. Exploratory research investigates a new phenomenon and is known for forming or developing. Also, exploratory studies are essential in discovering new insights and asking questions to assess a phenomenon in a new contest.

Descriptive research describes an event of interest without the intent of investigating causal relationships (Orlikowski & Baroudi, 1991). Thus, descriptive research focused on portraying an accurate profile of individuals, facts, events, or situations of a population (Glover *et al.*, 1994).

On the other hand, explanatory research attempts to link ideas by examining cause and effect – the relationship between different variables or phenomena (Orlikowski & Baroudi, 1991). To this end, this study adopted explanatory research to answer all the research objectives to make predictions of relationships and explain the characteristics of gamified users. As this study considered a cross-section of the population in HEI, an explanatory study is recognised as a

suitable research design for analysing phenomena, behaviours, problems, and situations at a point in time (Kumar, 1996).

As previously discussed, positivist research aligns with a systematic and rational approach to research and thus leads to employing quantitative methods. Researchers who employ quantitative methods usually but not always focus on the confirmatory phases of the research sequence – formulate a hypothesis, collect numeric data, and test the hypothesis. As opposed to qualitative methods that describe experiences, emphasize meaning, and explore a phenomenon in greater depth, the quantitative method focused on measuring, quantifying, or finding the extent of a phenomenon (Hair *et al.*, 2003). To this end, this thesis adopted a quantitative method of research as all aspects of the research process (identifying, assessing, proposition, and analysing information) are determined before collecting data (Kumar, 2019).

5.3.1 Survey

This study adopted survey research to augment the deductive and quantitative methods approach in data collection. Although other methods such as experiment, case study, action research, grounded theory, and ethnography exist as a research strategy, survey research is most appropriate for deductive, descriptive and explanatory inquiry of research of a similar kind (Pinsonneault, & Kraemer, 1993). The survey approach will help the researcher to discover preliminary concepts, refine concepts measurement, and responses likely to happen in the population. The survey in exploratory research determines the measure of the concept and how to measure the variables best (Pinsonneault, & Kraemer, 1993). In descriptive research, survey research aims to identify events, opinions, situations, and behaviours in a population. The analysis at the descriptive level is to establish facts and not for theory testing. For instance, it might examine what kind of game elements are used by individuals in an institution. Surveys in explanatory research are to determine the causal relations and test theory. Thus, the

explanatory survey research fundamental question is: *Does the hypothesised causal relationship exist, and does it exist for the reasons posited?*

The survey allows the collection of extensive data and describes a specific aspect of a population by posing questions as to where, who, what, how many, and how much (Saunders *et al*., 2009). Respondents' perceptions, attitudes, and behaviour are enquired about a particular event, mostly via a questionnaire. This study employed an online and paper-based questionnaire – a simple approach to tabulate and analyse (Cohen *et al*., 2002). Other surveys or data collection tools include structured interviews or observation (Venkatesh, Brown & Bala, 2013). Based on this insight, the most suitable research strategy to address the research questions is the *survey*. This research intends to explore gamification, user engagement, and the continued use of gamification in education. Hence, the survey method answers the proposed questions rather than archival records examination. On the other hand, the researcher is detached from the study and has no control over the results and the happenings (contemporary) of the events.

5.4 SAMPLING TECHNIQUE

Sampling is a relevant aspect of any survey research because of the significant effect on the output and quality of the research discoveries. Probability and non-probability sampling techniques are the two main sampling techniques identified in the literature (Saunders *et al.*, 2009). Probability sampling is a sampling technique that helps researchers select units from an identified population of the study. This technique is often aligned with a survey approach, where the chance of selecting each case is known in the population. With non-probability sampling, the probability of the cases selected is unknown from the population the researcher is studying (Saunders *et al.*, 2009). To this end, this study adopted a probability sampling technique.

There are three types of probability sampling techniques. However, this research used a stratified clustering sampling design (naturally divided groups for task activities) as compared to the systematic random sampling technique. The stratified clustering sampling design ensured that each potential student user of the learning management system or GIS in UNI-GAMI had an equal chance of selection in the sample. It better represents the overall population by providing more precise metrics. To keep the researcher independent, ensure objectivity, and generalise results, the sampling technique prevents sample selection based on personal choices. Thus, for this study, students were selected based on their experience with LMS or the gamified information system – i.e. a particular group within UNI-GAMI was of interest to this study. After identifying the population, the sample size was calculated using the effect size, power (β), and significant alpha values (α).

Consequently, students in a group of twelve were assigned a random number (even and odd). Students in the final group were assigned numbers from 1 to 5; the final random numbers picked were 1 and 3 in one group, another 2 and 4 and lastly, 3 and 5. Those that made the final list of participants were handed questionnaires in paper form or provided a link (online survey). Students who chose the paper-based questionnaire were given 20 minutes to fill it out before the commencement of the class or after, while students who preferred the online questionnaire were given five days to fill it. Two subsequent reminders at the pace of 48 hours were sent to inform students of their impending submission.

5.4.1 Selection of Student Participants

For research RO1, the survey participants are graduate and undergraduate students of UNI-GAMI who have had experience with the University's LMS. The University did not have a gamified system or course at the time of data collection. Data were collected from students enrolled in the Digital Literacy Training at the UNI-GAMI ICT Centre. The UNI-GAMI ICT

Centre runs IT training for students at the beginning of the semester as beginners or intermediate-level training. For this study, students available for training chose three available sessions per their timetable schedule: 1. Digital literacy 2. Microsoft office specialist, and 3. Statistical Package for Social Sciences. Students applied for spots via google forms, and each session (12) accommodated forty-seven (47) students. The total number of students who applied for the course was 564, of which the number changed as the training progressed. Students who registered for the training were in batches of twelve. Two hundred and one (201) questionnaires were retrieved. After sorting (non-response, inconsistent, and incomplete) and data entry, the responses examined were one hundred and eighty-five (185).

Roldan *et al*. (2012) have indicated the importance of addressing the sample size issues in a parametric test. Even though less restrictive measures exist, scholars suggest that to reach an acceptable level of statistical power, the sample size should be increased to 100 (Thompson *et al.*, 1995). Although the criteria have been used extensively, Roldan et al. (2012) have proposed that to attain a more accurate assessment, the sample size of each regression should be specified in line with Cohen's (1994) power table. In determining the sample size, it is essential to specify the expected effect size (ES), power (β), and significant alpha values (α) in the study. Generally, a power of 80% and an alpha of .05 are acceptable. Using an average ES of .15, β of .95, and α of .05 in line with Cohen (1994), a multiple regression was determined with four predictors to determine the study sample size. Overall, the results yielded a sample of N=121 – which implies that the sample of 185 for RO1, 124 for RO2 and 133 for RO3 exceeded all criteria for analysing the measurement models. Furthermore, using the minimum sample size estimation method (i.e. 10-times rule), the construct with the highest number of indicators is performance expectancy (5 indicators). In this regard, the sample size required for this thesis is 5 x 10 = 50. Thus, a minimum of 50 respondents is required, however, the questionnaire was

administered to over 400 student participants which exceeded the minimum sample size threshold per the "10-times" rule.

Introduction to Objective two and three: At the beginning of the course, the instructor introduced the students to the gamification system. To have information on each student, they were asked to create an account (using their student ID and first name). They were later included in the class-designated gamified learning community. In order to measure self-determination (basic psychological needs) and not thwart the autonomous feelings of the students, they were instructed to explore the gamified platform freely and frequently as and when they wanted. Students were assured that their experience with the platform would have no implication on their course grades at the exploration stage. However, students were informed that their experience with the platform (participation in task activities) would be examined at the end of the six-week course.

It should be noted that the researcher had no hand in the curriculum or gamified system design. Further, the researcher did not disclose his interest in gamification; however, the students were primarily asked to evaluate the potential of the Mlearn community in supporting technology learning environments. M-Learn is a game-based learning platform that permits institutions and instructors to gamify their curriculum or course. Students' experience was measured via cross-sectional surveys and was voluntary so as not to risk their autonomous feelings in the system usage.

For RO2, 124 undergraduate students from a large university in Ghana participated in this study and completed the two-page online survey during the semester. A course representative sent an invitation to participate in the online survey through the classes' WhatsApp groups, and the students were allowed to participate voluntarily (n=320). The researcher arrived at a 124 sample size by specifying the expected effect size (ES), power (β), and significant alpha values

(α). Using an average ES of .15, β of .95, and α of .05 in line with Cohen (1994), a multiple regression was determined with five predictors to determine the study sample size. Overall, the results yielded a sample of N=101, implying that the 124 sample for objective two exceed all criteria for analysing the measurement models.

Generally, students in HEIs are often considered leading actors in internet usage. However, the internet is not the only technology that HEIs have adopted to facilitate learning and teaching. With video games, game-based learning, and other technologies, students now have various motivational and entertainment system options available on their mobile phones to engage their learning skills. In general, students use game-based learning mobile applications (M-Learn) in a resource context. This is because such institutions critically need to utilise gamification to ease the classroom resource constraints, yet they receive the least research attention. Thus, university students are considered potential gamification users and a suitable target for this study. The game-based learning mobile applications are adopted in systematic research methods such as midwifery and nursing practices, knowledge sharing, collaboration, and engagement between students and between students and instructors. Students receive points, badges, and scores on successful completion of tasks as acknowledgements visible to other students on the leaderboards (to encourage challenge and add social aspects to badges and points). With more than 30 million users, gamified application has been globally accepted and recognised in online learning as the most associated with gamification as compared to other applications such as Quizizz, Edmodo, and Socrative (Dellos, 2015; Plump & LaRosa, 2017).

For RO3, the study collected data from student users of a gamified IS, referred to as M-Learn. The data were collected from an IT/Computer Science department in UNI-GAMI. M-Learn was adopted purposely for systematic learning of research methods to encourage knowledge-sharing, collaboration, and engagement between and among students and instructors. To

identify and gain key information from the university-wide, the researcher contacted the head of the School of Continuing and Distance Education department, who referred the researcher to the IT/Computer Science class. The M-Learn consists of different research methods design by other university instructors who served as a practice and a revision for the students. Students completing assignments or tasks in the research methods course receive points, badges, and leaderboards (PLB) recognition. PLB is used to facilitate competition and boost learning among the students. In determining the sample size, it is essential to specify the expected effect size (ES), power (β), and significant alpha values (α) in the study. Generally, a power of 80% and an alpha of .05 are acceptable (Hair *et al.*, 2003). Using an average ES of .15, β of .95, and α of .05 in line with Cohen (1994), a multiple regression was determined with the three main predictors to determine the study sample size from a population of 260. Overall, the results yielded a sample of N=133, implying that the sample for RO3 exceeded all criteria for analysing the measurement models as stipulated by Barclay, Higgins and Thompson (1995) and Chin (1998) – a minimum for SEM is 100.

5.4.2 Selection of the Gamification Platform

In the case of UNI-GAMI, two potential gamified applications (Sakai LMS and MLearn) were identified and analysed by the researcher based on van Roy and Zaman's heuristics (2017) for selecting gamified platforms in the context of education. Aside from the high level of engagement of the Sakai Leering management System, profile and a static (male and female design) avatar display was the identified game design elements. Unlike the MLearn, the system is tailored toward each user experience and offers a variety of interactions that the user is likely to enjoy. Figure 5 shows an example of a gamification interface as projected on screen and

phone.

Figure 5 Game as projected on screen and mobile phone

Thus, as van Roy and Zaman's heuristics (2017) suggested, the gamification system should have different types of game design elements, persuasive approaches, and activities that could be immersive and appealing to the student learner types. Additionally, there is a need for game mechanics that would allow the application to activate the appealing features specific to each student or user. Hence, the gamified system can be manual (the student gets to select the appropriate game element worth their experience) or automatic (the student is not allowed to modify the system's behaviour). Further, the selection of MLearn over the University's LMS was easy because it is a game-based learning platform (i.e. the initial design is based on game design elements) and designed with different types of interactive features (e.g. suspense music, explanatory videos). Importantly, the MLearn allowed the researcher to selectively enable and disable game elements (e.g. leaderboards, badges, feedback, levels, challenges etc.) to study and observe how the experiences and performance of the students differ with persuasive systems. On the other hand, users could enable the customisation of game elements that they feel attached to and want to use. These features led to this thesis selecting MLearn as the preferred gamification platform.

5.4.3 Selection of the University

While many institutions are still nascent in using new technologies, higher education institutions (HEIs) cannot underestimate its use due to the constant transformation happening in education. To cause revolutionary change in learning and teaching methodologies, Information and Communication Technology (ICT) has been touted as the way forward. Scrimshaw (2004) acknowledged the contribution of the innovation towards student-focused teaching and learning, and not necessarily the adoption and use of the technology. In developing economies, advancement has been slow because of an unsupportive global economic environment, lack of resources and educational materials, and poverty (Alkhawaldeh, & Menchaca, 2014).

The empirical section of the research is conducted in the Republic of Ghana – a Ghanaian University (referred to as UNI-GAMI, a pseudonym). With a gradual and cyclical improvement, Ghana is considered a developing economy in West Africa (UNDP, 2018). In this study, a developing economy is only used as a context. Higher education in Ghana is classified into private/public universities, technical universities, and colleges. There are ten technical universities and nine public universities. There has been an increase in the number of higher education institutions (HEIs) and enrolment in such institutions in Ghana. Private universities make up almost half the total number of HEIs, but only 19% of enrolment; public universities admit the most, on averagely 40% per academic year enrolment. College of education accounts for 27% of the total HEIs (Ministry of Education, 2018).

Over the years, the Ghana Education Trust Fund (GETFund) has funded most HEIs projects and initiatives through the national Value Added Tax. However, the shortage of lecturers, inadequate information and technologies, and student enrolment growth has given rise to IS acquisition, e.g., electronic systems. The Ministry of Education outlined the Ghana Education

Strategic Plan (2018-2030 report) and acknowledged that HEIs currently have in place less than 50% of information communication technology requirements and required materials. Additionally, the plan recommended an upgrade in teaching and learning facilities and public HEIs ICT (Ministry of Education, 2018).

Despite limited technology-mediated learning, HEIs have made progress in providing some form of electronic learning, especially for their distance learning programs. For example, the UNI-GAMI acquired the Sakai LMS in 2014 to take advantage of teaching and learning online. The Sakai is open-source software that enables student work activities like creating, distributing, managing, and retrieving course materials. Despite the advantages, unreliable internet access, low internet penetration, lack of sufficient training for students, power outages, and lack of capability to achieve pedagogical practices hinder higher education in developing economy's use of LMS. Researchers in their quest to enhance the use of learning systems to include enjoyment and fun, and engagement have called for the integration of games in HEIs learning and teaching in Ghana (Appiahene, Asante, Kesse-Yaw & Acquah-Hayfron, 2017).

UNI-GAMI was chosen as the study unit (to address the research objectives) because it is one of Ghana's largest and top-ranked universities. The reason for this is that such institutions have the greatest need for leveraging new technologies (gamification) to ease resource constraints in the classroom, and yet they receive the least research attention. Thus, the researcher identified some UNI-GAMI departments as championing gamification in Ghanaian HEIs, specifically with a gamified mobile learning application. As such, the university students, mostly undergraduates in UNI-GAMI were potential users of gamification and a suitable target for this research. Additionally, students at HEI were chosen because they are often considered leading internet users. However, the internet is not the only technology 1) they have integrated into their daily life (Yang, Asaad & Dwivedi, 2017) or 2) HEI has implemented for their use

to facilitate learning and teaching. With video games, game-based learning, and a plethora of technologies, various motivation and persuasive systems options are available on their mobile phones or at their disposal to engage their learning as to their predecessors.

5.6 RESEARCH METHODS FOR THE RESEARCH QUESTIONS

This study aims to develop a theoretical and practical oriented understanding of gamification antecedents and the outcome of adding game elements to learning in higher education institutions (HEI) in Ghana. To achieve this purpose, three research methodological approaches, specifically the research instruments and procedure, are explained.

5.6.1 Research Methods for Gamification Acceptance

The first objective of this study is *to explore students' gaming experience, perception and acceptance of adding game design elements to learning in higher education institutions in a developing economy context (evidence from Ghana*). In doing so, the study adopted the UTAUT and developed a research framework (see section 4.4.3 for further details). The UTAUT constructs adapted are considered the strongest predictors of acceptance and use behaviour and have been applied in education technology research (Barnes & Kennewell, 2017).

5.6.1.1 Research Instrument

This study used questionnaires to collect responses from the students. The questionnaire contained three sections, all administered in the English language. The section one of the questionnaire consisted of demographic questions and questions on computer game playing habits and preferences (see Appendix B1). The section two consisted of twenty-three (23) questions on a 7-point Likert scale. A 7-point Likert scale is easier to use, more accurate, and better reflects the true evaluation of respondents' views (Finstad, 2010). The measurement items were categorised to reflect the ten main constructs (performance expectancy, effort

expectancy, attitude toward gamification, image, facilitating conditions, behavioural intention, social influence, behavioural intention, trust, and quality). Out of the ten (10) constructs, this study included seven (7) constructs from the UTAUT model, and an additional construct was included by the researchers based on gamification constraints deduced from literature analysis (see Table 5.1). The additional trust construct was to measure the trust level with higher education services and the quality of the Sakai in hosting gamification. This study adopted two items from the construct of Image from Moore and Benbasat's (1991) construct of technology adoption. As a matter of validity, the item constructs were classified and adjusted in discussion with a faculty member and an IS expert at the UNI-GAMI. Insight from Son et al. (2011) aided in modifying the last question on the use of technology (LMS) frequency (from "several times each day" to "less than once a week"). The study adopted the UNI-GAMI ICT Centre LMS.

A minimalist view of gamification was presented to the participants since gamification is a new concept in Ghana. The participants' understanding of the term proved useful in answering the questions. The reluctance of students to use digital-based encourage the use of paper-based questionnaire. In controlling socially desirable responses, the participants were assured of *no wrong answers* to questions, and as such *honest* answers were required (Podsakoff *et al*., 2003). The data collection covered 14 days. Descriptive statistics, component matrix, Cronbach alpha, and correlations are performed to answer the research questions. The measurements were important in testing the relationship between the constructs and other variables and obtaining factors influencing students' acceptance of gamification.

Table 5.1 Summary of Scale Items for RO1

Theme	Research Objective	Construct	Source	No. of Questions
	Exploring user's gaming experience, perception, and acceptance of	Performance expectancy	Thompson *et al*., 1991	5
		Effort expectancy	Bourgonjon *et al.* 2010	4
		Social Influence	Bourgonjon *et al.* 2010	2

Defining and exploring gamification	gamification IN higher education institutions in Ghana	Attitude	Ajzen, 1991	3
		Facilitating conditions	Bourgonjon *et al.* 2010	3
		Image	Moore & Benbasat, 1991	2
		Trust	Authors' construct	2
		Behavioural intention	Venkatesh *et al.* 2003	3

5.6.2 Research Methods for User Engagement

The RO2 is to align the self-determination theory to gamification research *to determine how gamification supports students in higher education in their basic psychological needs.* The self-determination theory premises on the situational motivations factors to explain why people use technology to accomplish tasks on a personal and voluntary level is adopted (Suh *et al.*, 2018). The following is the outline of the research instrument and procedure.

5.6.2.1 Research Instrument

An online survey was conducted to test the research model empirically. The survey which approximately takes 16 minutes to complete, questioned gamified users (students) in a higher education institution. The questions included all variables (game design elements, need satisfaction, intrinsic motivation, and gamification outcome) essential in the model. Through a structural equation model (path analysis), the study tested the relationship between the variables to identify their statistical significance. Consequently, partial least squares (PLS) were chosen for this study because of its appropriateness in theory development at the early stages (Thompson, Barclay & Higgins, 1995).

Aside from the demographic question, the study adopted four categories of variables, which were measured on a 7-point Likert scale (see Appendix B2). First, the items of the game design elements were inspired by (PBL) Kankanhalli *et al*. (2005) and van Roy and Zaman's (2019)

scale. In testing for need satisfaction, this thesis adopted items from Standage *et al*. (2005) scale on autonomy and relatedness, and the competence scale from McAuley *et al*. (1989) and Jang *et al*. (2009). Each of the variables consisted of three items (see Table 5.2). The intrinsic motivation scale developed by Standage *et al*. (2005) was adopted to measure self-determination/motivation while the items for engagement were adapted from Standage *et al*. (2005) and Brockmyer *et al*. (2009). Considering recent studies on PBL and human interaction, gender, age, and level of study were the control variables (Hartmann & Klimmt, 2006).

Table 5.2 Summary of Scale Items for RO2

Theme	Research Objective	Construct	Source	No of Questions
User engagement with gamified information systems in education	Determine how gamification supports students' basic psychological needs	Reward /Competition	Kankanhalli et al. (2005) and van Roy and Zaman (2019)	4
		Need satisfaction – • Autonomy • Competence • Relatedness	Standage *et al.* (2005), McAuley *et al*. (1989) and Jang *et al*. (2009)	3 items each
		Intrinsic motivation	Standage *et al*. (2005)	3
		Engagement	Standage *et al*. (2005) and Brockmyer *et al*. (2009).	3

5.6.3 Research Methods for Gamification Continuance

Lastly, RO3 seeks to *determine how learners' aesthetic experience (motivation), information technology capabilities (abilities), and information quality (opportunity) contribute to the continuance use of gamification in education (aligning with the MOA theoretical perspective).* To achieve this, the Motivation Opportunity Ability theory (see 4.6.3 for further details) which assumes that, for any occurrence or non-occurrence of behaviour, the learner is affected by his or her characteristics (motivation, abilities) and the external environment (opportunities) is adopted (Maclnnis, Moorman & Jaworski, 1991). Figure 5.3 shows the highlight of the conceptual model developed for testing.

5.6.3.1 Research Instrument

The AE, perceived ITC, and IQ, as stated in the hypothesis development stage, are multidimensional constructs. Therefore, the measurement items were adapted from existing literature or validated scales. Each item was measured with a 7-point scale that ranged from 1 "strongly agree" to 7 "strongly disagree." However, new items were developed from literature specifically for the AE. Since not all the aesthetic experiences fit well with the CU context, the researcher reviewed extensive literature and developed a new scale to measure its multiple dimensions. The review focused on the perception surrounding CU experiences and CU behaviours context in IS education. Based on the literature cross-examination, four key dimensions of AE were identified, as discussed above. The construed dimensions of AE were rewards (Kankanhalli *et al.*, 2012), competition (Lee & Yang, 2011), self-expansion (Mattingly & Lewandowski, 2013) and meaning (Suh *et al.*, 2017). Some measures of aesthetic experience available in IS literature (Jiang, Wang, Tan & Yu, 2016) relate to users' first interaction with websites designed for promoting products and services and not for specific behaviours such as CU with learning management systems. Subsequently, further research on aesthetic experience tailored the measures to suit a particular context using various dimensions (Cai & Xu, 2011). As some of the aesthetic experience measures fit well with the CU context, the researcher developed the AE to measure its multiple dimensions. Items of perceived ITC were adopted from Fink (2011), while items for perceived IQ were adapted from Wixom and Todd (2005).

Table 5.3 Summary of Scale Items for RO3

Theme	Research Objective	Construct	Source	No of Questions
Continuance use of	Determine how aesthetic experience, information technology capabilities, and information quality	Information technology capability	Panda & Rath, 2021; Fink & Neuman, 2007	9
		Information quality	Wixon & Todd, 2005	12

gamification in education	contribute to continuance use of gamification	Aesthetic experience	Kankanhalli et al. 2012	11
		Continuance use	Bhattacherjee & Premkumar, 2010	3

5.7 DATA ANALYSIS

The two main statistical packages employed in this study are the Statistical Package for Social Sciences (SPSS) v. 23 and SmartPLS v. 3. In IS, the software is widely used and recommended for data analysis (Lowry & Gaskin, 2014). Precisely, the initial coding and input of data were done in SPSS to cater for the screening of missing data, outliers and multicollinearity issues (see section 5.7.2.1) (Hair *et al*., 2006). Moreover, other preliminary tests, such as descriptive statistics, were conducted using SPSS, while the resulting data was sent to SmartPLS to estimate causal networks and estimate the partial least squares. Partial least squares (PLS) were used because it is appropriate for developing an early-stage theory (Barclay *et al*., 1995).

5.7.1 ASSESSMENT OF MEASUREMENT MODEL

After conducting the preliminary test of factor loadings and descriptive statistics, the next stage is the measurement model assessment using Partial Least Square – Structural Equation Model (PLS-SEM). Thus, the estimation or assessment of the measurement models allowed the researcher to assess the strength of the indicators concerning the latent variables of the theories adopted (i.e. UTAUT, SDT and MOA). There are two main constructs: reflective and formative, and these constructs differ in its application to the indicators or measurement models (Hair *et al*., 2019). Aside from the four constructs (rewards, competition, self-expansion and meaning) – formative – applied to RO3, all other constructs in this thesis were reflective. To this end, the study conducted an estimation of dimensions in the full model (i.e. weight and t-values) aside from the usual measurement model reliability, validity and structural model

assessment. The assessment of the measurement model of this study addresses the following reliability and validity.

5.7.1.1 Indicator Reliability

Indicator reliability is defined as the extent to which a set of variables or a single variable is consistent in measuring what it intends to measure (Urbach & Ahlemann, 2010). Reflective indicator loadings were monitored to check for indicator reliability. According to Hair et al. (2019), loadings of 0.7 and above are recommended because they ensure reliability acceptance of the items and also indicate that the construct variable is responsible for explaining more than 50% of the indicator variance. All the indicators were significant on the first run of analysis, but in instances where the indicators do not load significantly, it is recommended they are removed (Hair *et al*., 2016). This means that this study's recommended minimum threshold of 0.7 was not a problem – all indicators loaded significantly on their corresponding construct variable. Thus, showing a good measurement of the latent variables – extraction of the results was followed to assess and evaluate the structural and measurement model.

5.7.1.2 Internal Consistency Reliability

The next step after testing the indicator reliability is testing internal consistency quality by using Cronbach's alpha. Indifference to the value or score renders an indicator internally consistent (see Hair *et al*., 2006). However, a high Cronbach alpha value indicates that the scores of the indicators in a construct variable are in a similar meaning and range (Cronbach, 1951). In this thesis, the minimum threshold for Cronbach alpha is 0.70 (Nunnally, 1978). As shown in Table 6.7, all the latent variables achieved an alpha value of 0.70 and above. Notwithstanding the used Cronbach alpha value of 0.70 and above (Nunnally, 1978), other researchers have criticised it as a less accurate measure of reliability and showing lower values as items are unweighted (Urbach & Ahlemann, 2010; Hair *et al*., 2019). To this end, alternative

measurements for indicator reliability such as composite reliability, and convergent and divergent validity have been suggested.

5.7.1.3 Convergent Validity

After the assessment of the internal consistency reliability, convergent validity is the next step of the analysis. Convergent validity is defined as the degree to which discrete items reflecting a construct converge in comparison to items measuring different constructs (Urbach & Ahlemann, 2010, p.19) and Average Variance Extracted (AVE) is used in assessing convergent validity. The squared and the mean value of each indicator loading are calculated for AVE's measure and have a threshold of 0.5 (Fornell & Larcker, 1981). Thus, the latent factor explains at least 50% of the item variance, demonstrating sufficient convergent validity (Fornell & Larcker, 1981; Urbach & Ahlemann, 2010; Hair *et al*., 2019). For example, as shown in Table 6.10, the AVE values are above the minimum 0.55 thresholds, indicating adequate convergent validity of results.

5.7.1.4 Evaluation of Discriminant Validity

Discriminant validity is the extent to which a construct is empirically distinct from the other in the structural model (Hair *et al.*, 2019). Discriminant validity is evaluated using two measures that are common to PLS-SEM. The first measure is the calculation of cross-loading, which results from the comparison or combination of individual latent variable measures with other items (Chin, 1998). In this instance, the indicator loadings are higher than for its constructs compared to other constructs, and each construct loads highest with its indicators. The second is the Fornell-Larcker criterion which compares the square root of the AVE with the correlation of latent constructs (Hair *et al.*, 2014). In this instance, the latent construct should better explain the variance of its indicator when compared with the variance of other latent constructs. Another measure of discriminant validity is the Heterotrait-Monotrait ratio. An HTMT value

close to 1 indicates a lack of discriminant validity (Kline, 2011). However, some scholars suggest a threshold of 0.85 or 0.90 to indicate discriminant validity (Henseler *et al.*, 2015). To establish the discriminant validity in this study, the Fornell-Larcker and Heterotrait-Monotrait ratio were used.

5.7.1.5 Composite Reliability

Composite reliability, unlike Cronbach alpha, assumes that all latent variables have different loadings. Hence, their values are better in measuring indicator reliability, i.e. reliability ranging between 0.6 and 0.7 are considered higher values and acceptable to "explanatory research" (Henseler, Ringle, & Sinkovics, 2009; Chin, 1998). While values between 0.7 and 0.9 indicate satisfactory to good indicators. For example, composite reliability values from Table 6.9 range from 0.74 to 0.90, thereby indicating "satisfactory to good" indicators.

5.7.2 STRUCTURAL MODEL ASSESSMENT

The next test after the measurement model assessment is the structural model assessment. This thesis highlights two essential steps to evaluate the structural model based on the research objectives. The model fit and predictive relevance were also assessed.

5.7.2.1 Assessing Structural Model for Multicollinearity Issues

The first step in evaluating the structural model is the examination of multicollinearity. The variance inflation factor (VIF) is used for assessing multicollinearity for each independent construct. A minimum threshold of 5 or less is required to avoid collinearity issues (Hair, Sarstedt, Ringle, & Mena, 2012). For a threshold to be met, the construct under consideration will show a perfect linear combination of independent variables in the equation (Hair *et al.*, 2012). From RO1, the VIF values ranged from 1.06 to 3.61, while RO2 VIF values ranged from 1.90 to 2.98, indicating that there are no collinearity issues in this study.

5.7.2.2 Assessing the Effect Size and Test of Significance

After Assessing the structural model for multicollinearity issues, the effect size of each path in the SEM is assessed through Cohen f^2. The effect size ascertains whether the independent variables have an influence (significant) on the dependent variable, i.e. it measures the extent of significance of the dependent indicators on the independent indicators (Cohen, 1988; Urbach & Ahlemann, 2010). For example, the F^2 values for RO1 show that independent constructs such as performance expectancy, effort expectancy and social influence have a small effect on behavioural intention (i.e. dependent variable). Thus, the values range from 0.002 to 0.101; however, facilitating conditions and trust had a large effect of 1.32 and 1.26 on behavioural intention to use gamification. Further, to support the model results and goodness of fit, the study tested for the chi-square coefficient (X^2) and chi-square degree of freedom(df) (Kline, 2011). The results from RO2 show results of $X^2 = 603.47$; X^2 / df= 3.38 indicate an acceptable measurement model fit. While the results for RO3 shows X^2= 493.3, df=210; X^2 / df = 2.34 indicate an acceptable measurement model fit (Kline, 2011). Furthermore, Goodness of Fit (GOF) is the subsequent analysis after determining the path coefficient's significance is conducted to determine whether the model is well or ill-fitted (Hair *et al.*, 2006) (see sections 6.2. and 6.3.3). In this regard, the root mean square error of approximation (RMSEA) and the incremental fit measure, thus the comparative fit index (CFI) and incremental fit index (IFI) were obtained.

Furthermore, predictive relevance (Q^2) is assessed to measure the endogenous variables. Q^2 measures the parameter estimates and assesses how well the model reconstructs the observed values. The predictive relevance is determined using the formula = (Q^2included-Q^2excluded)/(1-Q^2 included). Further, the estimation of dimensions in the model is determined

by the three-step approach of Baron and Kenny (1986) for estimating mediating effects. Section 6.3.4.4 details a complete analysis of the estimation of the dimensions.

5.8 CHAPTER SUMMARY

In summary, this chapter adopted a positivist research approach and quantitative research method (survey) to investigate how gamification can be tailored to meet students' motivation and engagement with gamified information systems. Additionally, the chapter highlights the research methodology and design, data collection process, analytical methods, and survey questionnaire approaches.

CHAPTER SIX

THEORY-DRIVEN GAMIFICATION EVALUATION RESULTS

6. OVERVIEW

The previous chapter presented the research methodology which highlighted the hypothesised relationship between the variables in the research framework—this chapter focus on presenting the outcomes of the hypothesis test. The chapter describes the evaluation and results of LMS and two versions of a gamified information system. The evaluation of the LMS was to assess students' readiness to accept gamification while the gamified version was evaluated to investigate whether gamification will promote positive learning engagement and motivation. This section also presents the descriptive statistics, reliability and validity of scales, factor analysis and cross-loadings, model assessment and the structural equation model.

6.1 GAMIFICATION ACCEPTANCE – RO1

This section presents two categories of results: *descriptive* and *inferential*. The descriptive results focused on the demographic exploration of the participants while the correlational results established the association among the various constructs in this study.

6.1.1 PRELIMINARY DATA PREPARATION

The survey instrument was distributed to 256 (refer to section 5.5) graduate and undergraduate students in UNI-GAMI. Out of 256, 201 completed surveys were returned, which represents a 78.5% response rate. The responses were coded into SPSS. Data verification and screening were followed to cleanse any missing data, errors or outliers by employing the normal probability plot and Whisker plots (Kline, 2011). Thus, after sorting (nonresponse, inconsistent, and incomplete) and data entry, the responses examined were one hundred and eighty-five (185). The next section outlines the demographic information of the respondents.

6.1.1.1 Demographic Information

Of the 185 respondents in this study, 46.5% were male and 53.5% female, which is fairly distributed but inconsistent with the gender distribution among the student population of UNI-GAMI in Ghana. However, the majority of the respondents (66.5%) were between 17-23 years old, which is consistent with the school-going age in Ghana. During the time of data collection, the first-year students were not enrolled in the IT training programme. Accordingly, the level of study percentage are as follows: year two (55.2%, *n* =102), year three (13.5%, *n* = 25), year four (8.6%, *n* =16) and postgraduates were 22.7% (*n* = 42); showing an approximately proportionally distributed respondent. Most of the respondents were regular students (76.8%, *n* =142), signifying the preferred mode of studies by Ghanaian students at the tertiary level. The majority of the respondents play games, and the results reveal a fairly distributed gender play. Playing games is a common activity and practice among the youthful population, preferably in games like puzzles and adventure. Players in this category are mostly the *Achievers and Explorers* – the prevalent gamer personality types.

Table 6. 1 Demographic Characteristic of the Respondents

Demographic Information	Categories	Frequency	Percent
Gender	Male	86	46.5
	Female	99	53.5
Age group	17-23	123	66.5
	24-30	30	16.2
	31 and above	32	17.3
Level of study	Level 100	-	-
	Level 200	98	53.0
	Level 300	25	13.5
	Level 400	16	8.6
	Postgraduate	42	22.7
Enrolment Type	Regular	142	76.8
	Distance	43	23.2
Playing habit: play games	Yes	168	90.8
	No	17	9.2
Preferred game type	Racing	27	14.6
	Shooter	9	4.9
	Adventure	42	22.7
	Strategy	17	9.2
	Multiplayer	24	13.0
	Puzzle	66	35.7

The majority of the students (45.9%) have less than 1-year of experience with the Sakai LMS, 31.4% of them have 1-3 years of experience and students with more than three years' experience were 3.8%. The students that do not use the Sakai platform were 18.9%. The students on average, logged in to Sakai less than once a week (47%, n=87) while (29.7%, n=55) of them logged into the Sakai platform about once each week when school was in session. Seventeen (9.2%) of the respondents' logged in several times each day, 18 (9.7%) logged in about once each day, and 8 (4.3%) logged in several times each week. On average, the length of time students spends every time they log on to Sakai is as follows: more than 60 minutes represents 1.1%; between 46 and 60 minutes – 5.9%; between 31 and 45 minutes – 31.4%; between 15 and 30 minutes – 25.4%; less than 15 minutes – 21.1% and students who chose not applicable were 15%. The students stated that they mostly log on to Sakai for three primary purposes: taking quizzes, downloading course materials, and checking plagiarism. Importantly, 85% of students have not noticed any game element in the UNI-GAMI LMS while 89.2% believe that they would be more productive if their learning was more gamified.

6.2.2 Assessment of Measurement Model

A method to examine a good construct representation in a conceptual framework is through validation of the measurement model. To validate the model, the reliability and validity of the constructs are assessed as follows.

6.1.2 Reliability

From the obtained results (Table 6.2), each construct represents its reliability coefficient. In total, the items from the UTAUT model yielded a reliability coefficient of 0.86. The implication is that the internal consistency of all the items is reliable.

6.1.3 Acceptance of Gamification: Constructs Validation

Each item of the main constructs was measured with a 5-point Likert scale. The students after the learning session rated a twenty-one (21) statement modelled according to UTAUT, based on gamification in education. The reliability of the test score was high, with a Cronbach's alpha of 0.86. The mean determines the average students' responses, while the standard deviation value shows the level of variation and closeness to the mean, as shown in Table 6.2.

When the researcher tested for internal consistency using Cronbach's alpha, all seven factors (PE, EE, AT, FC, IM, TR, and BI) obtained very good reliability (Cronbach's alpha >.70) as indicated in Table 6.2. With a mean of 3.66, the student's acceptance level of gamification was slightly more than the neutral. To analyse the goodness of fit and support the mean and SD results, the test for the chi-square coefficient (X^2) and chi-square degree of freedom was conducted. The results X^2= 603.47; df =178; X^2 / df = 3.38 indicate an acceptable measurement model fit (Kline, 2011).

Furthermore, as shown in Table 6.2.1, the obtained estimated model of root mean square error of approximation is 0.06, which conforms to the benchmark or saturation—implying that the measurement model fits the dataset. Also, the incremental fit measure, thus the comparative fit index (CFI) and incremental fit index (IFI) obtained in the estimated model are greater than the threshold of 0.90 (Hair *et al.*, 2010).

Table 6.2. Testing the mean and standard deviation of the construct items

Factors and items	Mean	Std. Deviation	Loadings
Performance Expectancy (α =0.849; AVE=0.71; CR=0.92) (Davis, 1989)	**3.94**	**0.90**	
PE1: Gamification would improve my academic performance	3.97	0.88	0.91
PE2: Gamification would allow me to do more work in less time	3.95	0.88	0.78
PE3: Gamification would make it easier to do my school work	3.89	0.86	0.85
PE4: Gamification would encourage interactive learning	3.91	0.94	0.74
PE5: Gamification would motivate and encourage learning	3.99	0.92	0.78
Effort Expectancy (α = 0.842; AVE=0.57; CR=0.85) (Bourgonjon et al. 2010)	**3.91**	**0.91**	
EE1: Learning to use a gamified system would be easy for me	4.00	0.73	0.90

EE2: Using a gamified system will be easy and without much help	3.76	1.01	0.70
EE3: It would be easy for me to become skilful using gamification	3.93	0.95	0.83
EE4: I would find gamification easy to use because of my game skills and use of Sakai	3.95	0.92	0.78
Social Influence (α = 0.781; AVE=0.61; CR=0.73) (Bourgonjon et al. 2010)	**3.35**	**0.87**	
SI: My friends will like it if I choose to learn with games	3.22	0.83	0.71
SI2: Friends use games to learn	3.47	0.92	0.79
Attitude (α = 0.841; AVE=0.67; CR=0.87) (Ajzen, 1991)	**4.29**	**0.79**	
AT1: I think gamification is a good idea for students	4.22	0.81	0.87
AT2: I think gamification is a good idea for the university	4.22	0.85	0.78
AT3: I am interested in using computer games in learning	4.43	0.73	0.86
Facilitating Conditions (α = 0.864; AVE=0.81; CR=0.82) (Bourgonjon et al. 2010)	**3.60**	**0.91**	
FC1: My familiarity with Sakai and playing games would equip me in using other added features such as gamification	3.54	0.83	0.75
FC2: There is a specific person or unit available for assistance with any technical problem I may encounter	3.65	0.99	0.80
Image (α = 0.863; AVE=0.78; CR=0.90) (Moore & Benbasat, 1991)	**3.36**	**0.88**	
IM1: I think that people who use gamification in learning are getting a better education	3.41	0.87	0.87
IM2: I think that people who use gamification have bragging rights and social capital to achieve a high score	3.30	0.89	0.89
Trust (α = 0.869; AVE=0.84; CR=0.93) Author's construct	**3.27**	**1.02**	
TR1: The UNI-GAMI internet is trustworthy for gamification services in Sakai	3.02	1.12	0.82
TR2: The UNI-GAMI ICT can be trusted to carry out gamification in Sakai	3.51	0.91	0.71
Behavioural Intention (α = 0.866; AVE=0.62; CR=0.91) (Venkatesh et al. 2003)	**4.57**	**0.61**	
BI1: I intend to use gamification in the future	4.54	0.65	0.91
BI2: I plan to use gamification in the future	4.64	0.55	0.76
BI3: I intend to recommend gamification to friends in the future	4.52	0.62	0.81

The correlation coefficient was deducted to establish the relationship between the key variables. As shown in Table 6.3, a moderate positive correlation is identified among the constructs within the acceptance scale (1-10); though some correlation is significant, their relationship is negative, e.g. social influence and effort expectancy or trust. The strongest among the level was the relationship between attitude and acceptance of gamification (r=.821, p>.01), followed by performance expectancy and attitude (r=.66, p>.01). The plausible explanation for a high correlation value of .821 is that attitude is a good predictor of behaviour which is acceptable in this study. The weakest among the acceptance scale was the relationship between user behaviour (new construct introduced) and facilitating conditions (r=.27, p<.01). The following three (3) associations in the acceptance scale were significant at p<.05 and the

highest at that level; performance expectancy and image (r=.18, p<.05), attitude and image (r=.18, p<.05), and trust and use behaviour (r=.18, p<.05).

Table 6.2.1 Goodness of fit indices

Goodness of fit Indices	Benchmark	Estimated model
Root mean square error of approximation (RMSEA)	⩽0.08	0.06
Comparative fit index (CFI)	⩾ 0.90	0.93
Incremental fit index (IFI)	⩾ 0.90	0.96

The new construct introduced (Trust) had a moderate level of acceptance (Cronbach's alpha >.70). On average, the students indicated a moderate level of trust in the UNI-GAMI's staff support (M=3.26, SD= .15). In particular, the average student purported to disagree that the UNI-GAMI internet is trustworthy for supporting gamification in Sakai (M=3.02, SD = .12). Additionally, the results revealed a negative correlation between the trustworthiness of Sakai hosting gamification services, precisely the UNI-GAMI internet stability, and age (r=-.40, p<.01). In summary, the trust scale had a significant relationship with only two of the ten variables, namely facilitating conditions and use behaviour of technology. The quality of the LMS (Sakai attractiveness, organisation, and availability) had a negative correlation with effort expectancy (r=-.22, p< .01) but had a small positive relationship with attitude (r=.30, p<.05) and facilitating condition (r=.30, p<.05).

Table 6.3 Correlations between Key Variables

Constructs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1.Performance expectancy	1										
2.Effort expectancy	.52**	1									
3. Attitude	.66**	.58**	1								
4. Image	.18*	.16*	.18*	1							
5. Facilitating condition	.08	.34**	.38**	.43**	1						
6. Use behaviour	-.23**	-.16*	.14	.03	.27**	1					
7. Trust	-.04	.10	.05	-.12	.17*	.18*	1				
8. Quality	-.13	-.22**	.30**	.05	.30**	.35**	.30**	1			

9. Age	.18*	.18*	.18*	.35**	.23**	.08	-.40**	-.09	1		
10. Social influence	-.08	-.07	-.08	.31**	.12	-.07	-.08	.10	.13	1	
11.Acceptance of gamification	.56**	.58**	.821**	.38**	.61**	.41**	.34**	.43**	.18**	.06*	1

**. significant at the 0.01 level (2-tailed).
*. significant at the 0.05 level (2-tailed).

6.1.4 Computation of Predictive Factors

The study conducted Multiple Linear Regression to explain the relationship between the variables. The results for all the constructs showed a strong internal consistency of 0.86. The MLR was used to predict the students' behavioural intention toward gamification adoption in Ghana. The dependent variable identifier of the model is Behavioural Intention (BI), while the independent variable was Performance Expectancy (PE), Effort Expectancy (EE), Attitude (AT), Image (IM), Institutional-based Trust (TR), Facilitating Conditions (FC) and Social Influence (SI). The following shows the model summary.

Table 6.4 Model summary

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.847[a]	.717	.706	.098011	.717	64.092	7	177	.000

a. Predictors (Constant), SI, TR, AT, IM, FC, EE, PE

Table 6.5. ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	430.977	7	61.568	64.092	.000[b]
	Residual	170.029	177	.961		
	Total	601.005	184			

a. Dependent Variable: BI

b. Predictors: (Constant), SI, TR, AT, IM, FC, EE, PE

6.1.5 Reliability of the Constructs

Overall, the internal consistency of the model is 0.862 representing 86% reliability of the constructs. This indicates a strong internal consistency of the model. Table 6.1 also shows the individual reliabilities of the constructs (PE – 0.85, EE – 0.84, AT – 0.84, FC – 0.86, TR – .87, IM – .86 and BI – 0.87).

Table 6.6 Regression coefficients

		Unstandardized Coefficients		Standardized Coefficients		
Model		**B**	**Std. Error**	**Beta**	**t**	**Sig.**
1	(Constant)	1.350	.724		1.864	.064
	PE	.421	.055	.362	7.588	.000
	EE	-.077	.030	-.132	-2.561	.000
	AT	.509	.052	.604	9.821	.000
	IM	.052	.032	.096	1.648	.101
	FC	.060	.076	.041	.795	.428
	TR	.306	.042	.302	7.265	.000
	SI	.393	.091	.182	4.313	.000

Significance is p<.005; Dependent Variable: BI

From Table 6.4, the study confirms the predictor variables as significant because the p-value for the model is 0.000. The implication is that the model is statistically significant at F= 64.092, df = 177, 7, sig. = 0.000. The overall Adjusted R Square showing the relationship between the dependent and independent variables is 0.706 while the Multiple R is 0.717 (see Table 6.5). The value indicates the acceptance of the overall model. Therefore, 71.7% of the overall model explains the variance in students' behavioural intention to adopt gamification in learning in Ghana. The MLR model with the seven constructs yielded R^2 = .717, F (7, 177) = 64.092 with ≤ .05 significance level (see Table 6.5). As shown in Tables 6.6 and 6.7, PE, EE, AT, TR, and SI are significant predictors of Behavioural Intention. Therefore, H_1, H_2, H_4, H_5, and H_6 are accepted. The remaining, IM (p-value = .101) and FC (p-value = .428) are rejected. Also, the effect size was assessed using Cohen's F^2 value as shown in Table 6.7. *F^2 values less than* 0.02 indicate no effect, while 0.02, 0.15 and 0.35 indicate small, medium, and large effect sizes, respectively. The collinearity assessment was estimated using the variance of inflation factor

(VIF). A VIF value of 5 or less shows no collinearity issue (Hair *et al*., 2016). Table 6 shows that among the constructs, only Image is slightly above the threshold of 5.

6.1.5.1 Discriminant Validity

To examine the discriminant validity, the Fornell-Larcker and Heterotrait-Monotrait ratio were used. The Fornell-Larcker criterion, as shown in Table 6.6.1 explains the variance better of its indicator when compared with the variance of other latent constructs. Another measure of discriminant validity is the Heterotrait-Monotrait ratio which is shown in Table 6.6.2. HTMT value close to 1 indicates a lack of discriminant validity. From Table 6.6.1, all the HTMT values did not exceed the 0.90 thresholds, implying that the various latent variables are distinct and different from each other (Kline, 2011; Henseler *et al.*, 2015).

Table 6.6.2 Fornell-Larcker Criterion

	PE	EE	FC	AT	SI	TR	IM	BI
PE	0.906							
EE	0.408	0.912						
FC	0.286	0.792	1.000					
AT	0.405	0.748	0.812	0.933				
SI	0.450	0.652	0.665	0.743	1.000			
TR	0.411	0.377	0.364	0.396	0.634	1.000		
IM	0.236	0.636	0.583	0.578	0.765	0.625	1.000	
BI	0.589	0.661	0.561	0.747	0.866	0.500	0.598	0.971

Table 6.6.1 Heterotrait-Monotrait Ratio (HTMT)

	PE	EE	FC	AT	SI	TR	IM	BI
PE								
EE	0.496							
FC	0.307	0.883						
AT	0.473	0.900	0.833					
SI	0.497	0.728	0.665	0.806				
TR	0.452	0.422	0.364	0.432	0.634			
IM	0.252	0.717	0.583	0.629	0.765	0.625		
BI	0.682	0.759	0.578	0.833	0.893	0.516	0.617	

Table 6.7. Summary of hypothesis test

Relationship	P-value	f^2	VIF	Support
H_1: Performance expectancy => Behavioural intention	.000	0.61	2.15	Supported
H_2: Effort expectancy => Behavioural intention	.000	0.02	1.45	Supported
H_3: Facilitating conditions => Behavioural intention	.428	0.00	4.06	Not Supported
H_4: Attitude => Behavioural intention	.000	0.31	2.64	Supported

H_5: Social influence => Behavioural intention	.000	0.14	1.43	Supported
H_6: Trust => Behavioural intention	.000	0.22	2.39	Supported
H_7: Image => Behavioural intention	.101	0.03	5.03	Not Supported

From the analysis of the data and measurement items, two constructs (PE and EE) of the original UTAUT model may be considered as *technology and learner attributes*, while the remaining two (SI and FC) may be considered as *institutional factors or outcomes* that influence students' behaviour in a developing economy. A significant omission and less reliance in the conceptualisation of the original UTAUT model as shown in the theoretical build-up is *institutional-based trust* and attitude in influencing students' engagement with the GIS. The analyses revealed the modification of the original UTAUT model with institutional-based trust and attitude as the main ***psychological safety factors*** necessary for the uptake of GIS. Based on the findings, I propose institutional-based trust and attitude as an integral part of the UTAUT model in developing economies' acceptance of technology. Future research in developing economies should focus on identifying psychological and contextual factors necessary for formalising an alternative theoretical model for explaining the UTAUT model and acceptance of information systems innovation.

6.1.6 Moderation Analysis

The results of the moderating analysis as shown in Table 6.8 indicate that not all of the hypotheses are supported. Only three of the hypothesized paths were significantly moderated by gender and age. Thus, the relationship between performance expectancy ($\beta = 0.159$) to behavioural intention is moderated by age or generation with a t-value of 2.075. Also, the relationship between social influence and behavioural intention is moderated by age and gender, with a t-value of 2.497 and 2.169, respectively. This shows that age does not moderate effort expectancy, facilitating conditions and social influence relationship with behavioural intention to use GIS.

Table 6.7.1 Results of Moderation Analysis

Path	Coefficient *β*	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Support
H1a: PE*AGE -> BI	0.159	0.076	2.075	0.038	Supported
H1a: PE*GDR -> BI	0.029	0.056	0.526	0.599	Not Supported
H2a: EE*AGE -> BI	0.079	0.082	0.969	0.333	Not Supported
H2a: EE*GDR -> BI	0.074	0.072	1.028	0.305	Not Supported
H3a: SI*AGE -> BI	0.138	0.080	2.479	0.032	Supported
H3a: SI*GDR -> BI	0.114	0.053	2.169	0.031	Supported
H4a: FC*AGE -> BI	-0.070	0.037	1.902	0.058	Not Supported
H4a:FC*GDR -> BI	0.172	0.047	2.501	0.061	Not Supported

6.2 LEARNER ENGAGEMENT – RO2

Using the PLS-SEM, this section tested the hypothesised self-determination model. The research followed the two-stage analytical procedure proposed by Anderson and Gerbing (1988). The researcher first tested the measurement model for validity and reliability and examined the structural model and its related latent variables.

6.2.1 Preliminary Data Preparation

The RO2 solicited information from 139 respondents (see section 5.5) offering Nursing and Midwifery programmes at UNI-GAMI. Out of the 139, 130 completed surveys were returned, which represents a 93.5% response rate. Data verification and screening were followed to cleanse any missing data, errors or outliers by employing the normal probability plot and Whisker plots (Kline, 2011). The verification and screening reviewed that more than 6% of the data were missing, resulting in deleting ten responses. Hence, the resulting sample is 124, representing 89.2% response rate. The following section outlines the demographic information of the sample used and the measurement of items.

6.2.1.1 Demographic Information

Most of the respondents were female (63.4%) which is not surprising since the department that has adopted gamification for teaching and learning was dominated by females (i.e. Nursing and Midwifery Department). Moreover, the data is dominated by students between 16 to 23 years. At the time of data collection, the first year students had not commenced their studies, not to mention the use of GIS for teaching and learning. The continuing students that used the GIS were dominated by the third year, testifying to their huge number in the department. Further, Students testified that gamification makes them feel more productive (81.1%) and excited (94.1%) while learning or teaching is in progress. 75.7% of the students say that gamification in learning process would make continuous learning attractive and desirable.

Table 6.8 Demographic Characteristics of the Respondents

Demographic	Category	Frequency	Percent (%)
Gender	Male	38	30.6
	Female	86	63.4
	Total	**124**	**100**
Age	16-19	19	15.3
	20-23	53	42.7
	24-27	35	28.2
	28 and above	7	5.6
	Total	**124**	**100**
Level of study	Second year	48	38.7
	Third year	62	50.0
	Fourth year	14	11.3
	Total	**124**	**100**

6.2.2 Assessment of Measurement Model

A method to examine a good construct representation in a conceptual framework is through validation of the measurement model. To validate the model, the reliability and validity of the constructs are assessed in this section.

6.2.2.1 Indicator Reliability

Construct reliability was first assessed using the indicator loadings and subsequently using Cronbach's alpha value ≥ 0.7. As shown in Table 6.9, each item's indicator loadings are high and range from 0.70 to 0.93. It is recommended that an indicator loading of 0.50 and above

prove that an item is reliable. However, 0.70 and above shows that the construct variable explains more than 70 percent of the indicator variance. The Cronbach alpha values for each item exceeded the recommended threshold of 0.7 (Nunnaly, 1978). Furthermore, from the measurement model, the composite reliability (CR) exceeded the suggested threshold (CR≥ 0.6. Thus, the CR values ranged from 0.83 to 0.93, indicating a good reliability level.

Table 6.9 Construct Reliability

Construct	Item code	Factor Loadings	rho_Ac	CR	AVE	(α)
Competition	CMP1	0.75	1.06	0.83	0.56	**0.806**
	CMP3	0.79				
	CMP4	0.70				
	CMP5	0.84				
Rewards	REW1	0.84	0.86	0.90	0.70	**0.855**
	REW2	0.91				
	REW3	0.83				
	REW4	0.76				
Autonomy	AUT1	0.81	0.73	0.84	0.59	**0.801**
	AUT2	0.80				
	AUT3	0.75				
Competence	CPT1	0.71	0.86	0.88	0.71	**0.742**
	CPT	0.76				
	CPT	0.81				
Relatedness	REL1	0.92	0.90	0.93	0.83	**0.895**
	REL2	0.92				
	REL3	0.88				
Course satisfaction	CSA1	0.88	0.88	0.92	0.79	**0.863**
	CSA2	0.89				
	CSA3	0.88				
Engagement	ENG1	0.91	0.91	0.94	0.83	**0.901**
	ENG2	0.93				
	ENG3	0.89				

Note CMP – Competition, REW – Rewards, AUT – Autonomy, CPT – Competence, REL – Relatedness, CSA – Course Satisfaction, ENG – Engagement, α – Cronbach alpha

Furthermore, the composite reliability of specific latent variables is also determined by Rho_A. It is recommended that a value of 0.70 or higher is considered significant (Hair *et al.*, 2011).

From Table 6.9, it is observed that all the Rho_A values of the latent variables are higher than 0.70.

6.2.2.2 Convergent Validity

Convergent validity is assessed by average variance extracted (AVE). As indicated in Table 6.9, each item measuring a specific construct showed a high factor loading. AVE value of 0.5 thresholds indicates the item's validity (Hair *et al*., 2019). Thus, there is sufficient convergent validity if the latent variables explain at least 50 percent of the items' variance (Hair *et al*., 2019). As shown in Table 6.10, the AVE values are greater than 0.5 connoting adequate convergent validity.

Table 6.10 Correlation Matrix with AVEs

Constructs	1	2	3	4	5	6	7
CMP	**0.75**						
REW	0.39	**0.84**					
AUT	0.35	0.55	**0.76**				
CPT	0.43	0.32	0.38	**0.84**			
RLD	0.21	0.41	0.31	0.48	**0.91**		
CS	0.51	0.38	0.34	0.29	0.51	**0.89**	
ENG	0.62	0.48	0.52	0.56	0.49	0.66	**0.91**

Note: AVE – represent the diagonals; off-diagonals – represent the squared correlations

6.2.2.3 Discriminant Validity

To establish the discriminant validity, the Fornell-Larcker and Heterotrait-Monotrait ratio were examined in this study. The Fornell-Larcker criterion explains the variance better of its indicator when compared with the variance of other latent constructs (see Table 6.11). Additionally, an HTMT value close to 1 indicates a lack of discriminant validity. From Table 6.12, all the HTMT values did not exceed the 0.90 thresholds, implying that the various latent variables are distinct and different from each other (Kline, 2011).

Table 6.11 Fornell-Larcker Criterion

Constructs	Autonomy	Competence	Competition	Satisfaction	Engagement	Relatedness	Rewards
Autonomy	0.751						
Competence	0.381	0.844					
Competition	0.226	0.281	0.745				
Satisfaction	0.473	0.467	0.320	0.885			
Engagement	0.441	0.478	0.273	0.808	0.910		
Relatedness	0.189	0.447	0.179	0.391	0.558	0.909	
Rewards	0.436	0.232	0.195	0.498	0.498	0.173	0.836

Table 6.12 Heterotrait-Monotrait Ratio (HTMT)

Constructs	Autonomy	Competence	Competition	Satisfaction	Engagement	Relatedness	Rewards
Autonomy							
Competence	0.457						
Competition	0.306	0.260					
Satisfaction	0.566	0.524	0.404				
Engagement	0.523	0.525	0.311	0.840			
Relatedness	0.240	0.503	0.175	0.430	0.620		
Rewards	0.525	0.264	0.301	0.584	0.332	0.195	

6.2.3 Structural Model Assessment

After assessing the measurement model which proved to be reliable and validated, this section focused on determining the structural model in the following steps: multicollinearity issues, the significance of the path coefficient, goodness of fit and effect size, and predictive relevance.

6.2.3.1 Assessing Multicollinearity Issues

The first step in assessing the structural model is examining multicollinearity. The variance inflation factor (VIF) index is used to assess multicollinearity issues. To avoid multicollinearity, a minimum threshold of 5 or lower is required. From the analysis in Table 6.13, the VIF score is between 1.00 to 2.371 and is below the suggested threshold estimate of 5 (Harter, Schmidt & Hayes, 2002). This shows that the problem of multicollinearity was an unlikely issue in this research.

Table 6.13 Multicollinearity Statistics (Inner VIF)

Constructs	Autonomy	Competence	Competition	Satisfaction	Engagement	Relatedness	Rewards
Autonomy				1.171			
Competence		1.040		1.410			
Competition						2.37	
Satisfaction					1.000		
Engagement							
Relatedness				1.250			
Rewards	1.000	1.040					

6.2.3.2 Assessing the Significance of Path Coefficient

To evaluate the significance of the path coefficient between the construct variables, a bootstrapping algorithm was run using 500 subsamples in SmartPLS. The results show that the path coefficient between autonomy and enjoyment (course Satisfaction) (β=0.328, t = 1.980), competition and competence (β= 0.347, t = 2.680), between competition and relatedness (β=0.384, t = 2.686), enjoyment and engagement (β=0.812, t = 11.498), relatedness and enjoyment (β=0.289, t = 2.032) and rewards and autonomy (β=0.560, t = 6.281) were all significant at 0.01 offering support to H1, H2, H3, H5, H7 and H8. However, the path coefficient between reward and competence (β= 0.225, t = 1.778), and competence and enjoyment (β= 0.171, t = 1.029), were both non-significant, thereby rejecting H4 and H6. The results are shown in Table 6.12. Also, in the structural model, it was observed that 33.7% of students' course satisfaction is explained by autonomy, competence, and relatedness, and the control variables and 65.9% of user engagement. In addition, 31.3% of the variance of autonomy is explained by rewards, 23.9 % of the variance of competence is explained by competition and rewards, and 14.7% of the variance of relatedness is explained by competition.

Table 6.13 Structural Model Results

Relationship	Original Sample (O)	T- Statistics	P-Values	Results
H1 Competition => Competence _	0.347	2.680	0.008	Supported

H2 Competition => Relatedness _	0.384	2.686	0.007	Supported
H3 Reward => Autonomy _	0.560	6.281	0.000	Supported
H4 Reward => Competence _	0.225	1.778	0.076	Not supported
H5 Autonomy => Course Satisfaction _	0.328	1.980	0.048	Supported
H6 Competence => Course Satisfaction_	0.171	1.029	0.304	Not supported
H7 Relatedness => Course Satisfaction _	0.384	2.686	0.007	Supported
H8 Course Satisfaction => Engagement_	0.812	11.498	0.000	Supported

6.2.3.3 Assessing the Goodness of Fit and Effect Size

The Goodness of Fit (GOF) is the subsequent analysis after determining the path coefficient's significance. The importance of GOF is to determine whether the model is well or ill-fitted. This helps the researcher determine if the data follows a normal distribution pattern (Hair *et al.*, 2006). The most widely used criteria for assessing GOF is R square determination coefficient (R^2) which varies from 0 to 1 (Hair *et al.*, 2019). According to Henseler *et al.* (2009), the coefficient of determination is important in measuring the overall effect size and variance explained in the endogenous construct for the structural model. Consequently, serve as a measure of the model's predictive accuracy. To assess the explanatory power of the R^2 values, Hair *et al.* (2011) classify the values as weak (0.25), moderate (0.50) and substantial (0.75). Similarly, Chin (1998) groups them into weak (0.19 or lower) average (0.333+-) and substantial (0.67) indicate approximate values. As shown in Table 6.14, the R^2 value is 0.652; hence considered a substantial value accounting for 67% variation of endogenous factors (Hair *et al.*, 2019).

Table 6.14 R Squared

Constructs	R Square	R Square Adjusted
Course satisfaction	0.359	0.338
User Engagement	0.652	0.649

In assessing the effect size (effect of independent on the dependent construct), Cohen's f^2 was computed (Cohen, 1988). Similar to the GOF, the PLS algorithm was run to determine the f^2 values. The independent construct is small when the f^2 values fall between 0.020 and 0.150, or medium between 0.150 and 0.350 or considered to have a large effect if the value is above 0.350 on the dependent construct (Cohen, 1988). Consequently, Table 6.14.1 shows that the independent construct, i.e. competence and relatedness indicate a small effect, while autonomy had a medium effect on the dependent construct, i.e. course satisfaction. Course satisfaction also showed a large effect on user engagement with gamification.

Table 6.14.1 Effect Size, f^2

Constructs	Autonomy	Competence	Competition	Satisfaction	Engagement	Relatedness	Rewards
Autonomy				0.155			
Competence		0.065		0.063			
Competition						0.033	
Satisfaction					1.878		
Engagement							
Relatedness				0.060			
Rewards	0.234	0.037					

6.2.3.4 Assessing the Predictive Relevance

The final step after determining the effect size was to assess the predictive relevance (Q^2). It measures the endogenous variables' predictive relevance (Stone, 1974). According to Stone (1974), the Q^2 measure how well the observed values are reconstructed by its parameter estimates and the model. Thus, to test the Q^2, a blindfolding cross-validation and synthesis of function fitting through omission distance were followed. The blindfolding process was run in SmartPLS to estimate the residual variance by assuming a specific number of missing cases. To determine the predictive relevance, the formula (Q^2included- Q^2excluded)/(1-Q^2 included). Structural models with Q2 values higher than 0, 0.25 and 0.50 are considered to exhibit predictive relevance (Hair *et al.*, 2019). The results of Q^2 are shown in Table 6.14.2.

Table 6.14.2 Q Square (Q^2)

Construct	Q^2 included	Q^2 excluded	Q^2
Autonomy	0.231	0.159	0.093
Competence	0.231	0.211	0.026
Relatedness	0.231	0.212	0.024

6.3 GAMIFICATION CONTINUANCE USE – RO3

In this section, the measurement and structural model were estimated using the Partial Least Squares technique (Chin, 1988). It is a component-based approach that minimises the residual variance of the entire model's dependent variable (Hair *et al*., 2016). Similarly, a two-way analytical method was used to test the measurement model and the structural model.

6.3.1 Preliminary Data Preparation

The survey instrument was distributed to 203 undergraduate students from the IT/Computer Science department of UNI-GAMI. Out of the 203, 133 completed surveys were returned, which represents 65.5% response rate. Compared to RO1 analysis, the response rate was low. A possible reason is that most of the respondents were distant learning students with limited contact with the school, instructor and the researcher. Data verification and screening were followed to cleanse any missing data, errors or outliers by employing the normal probability plot and Whisker plots (Kline, 2011). Thus, after sorting (nonresponse, inconsistent, and incomplete) and data entry, the number of responses remained the same (i.e. 133). The next section outlines the demographic information of the sample used and the measurement of items.

6.3.2 Demographic Information

An online survey was delivered to 203 students who used the M-Learn for learning research methods. The process was carefully controlled to reach out only to the users of M-Learn to participate in the survey. The results indicate that majority of the respondents were males (72.2%), which is not surprising since IT and Computer Science are predominantly male-

dominated programmes. Compared to RO1 and RO2 results, this group of respondents look mature with a minimum age of 20. Half of the respondents were 28 years and above, as seen in Table 6.15. A possible reason is that most mature students in Ghana prefer distant learning programmes that afford them a work-and-school life.

Table 6.15 Demographic characteristics of the respondents

Demographic	Category	Frequency	Percent
Gender	Male	96	72.2
	Female	36	27.8
	Total	**133**	**100**
Age	20-23	59	44.4
	24-27	29	21.8
	28 and above	45	33.8
	Total	**133**	**100**

6.3.3 Assessment of Measurement Model

This study evaluates the results in PLS-SEM by examining the measuring models. This is important because it helps the researcher estimate the measurement models concerning the adopted theories and the data collected (Hair *et al.*, 2016). Out of the four main constructs, one was formative (aesthetic experience) and the three others were reflective; as such, the reliability and validity of the measurement models are ascertained in the following sections before assessing the structural model. To handle the formative construct, an estimation of the weights of the aesthetic experience was conducted.

6.3.3.1 Measurement Model Validation

In testing the measurement model of the reflective constructs, the discriminant and convergent validity and internal reliability were used. Internal reliability, which measures the correlation between items, was examined using Cronbach alpha. The Cronbach alpha values shown in Table 6.16 are all above 0.6, which indicates sufficient internal consistency reliability among the latent variables (Nunnaly, 1978).

6.3.3.2 Convergent Validity

To examine the convergent validity of the constructs, three criteria were used: the composite validity of a minimum value of 0.7; the average variance extracted minimum value should be 0.5 and items loadings should be statistically significant and greater than 0.7 (Hair, Black & Babin, 2009). PLS was used to estimate the correlations among the first-order factors, which included sub-dimensions of the perceived constructs (IQ, ITC, and AE). As shown in Table 6.16, all the items passed the validity and reliability test, with the composite reliability ranging from 0.724 to 0.931 and AVE from 0.501 to 0.820. The item loadings are all higher than 0.7, indicating sufficient convergent reliability (Hair *et al.*, 2003) (see Appendix A2 pg. 229 for Loadings and Cross Loadings).

Table 6. 16 Measurement Items

Construct and measurement items	**mean**	***Std dev.***	***Loading***
Perceived information technology capability (ITC)			
***Technical capability* (α=0.801, CR=0.881, AVE=0.713)**			
I am skilled in using gamification and IT learning tools	1.75	1.258	0.850
I am skilled in distributed computing in education and have achieved most goals	2.17	1.329	0.806
I am skilled in developing web-based applications for learning and obtain important outcomes	3.01	1.647	0.658
***Behavioural capability* (α=0.95, CR=0.799, AVE=0.573)**			
I am self-directed and proactive to use the IS	2.20	1.570	0.916
I can plan, organise and lead assignments on the IS	2.76	1.793	0.813
I can plan and execute work in a collective IS environment	2.64	1.738	0.831
***Learning (education) capability* (α=0.95, CR=0.931, AVE=0.820)**			
I am knowledgeable about educational IT functions and have overcome many challenges successfully with IT	2.40	1.595	0.901
I am encouraged to learn new information technologies	2.43	1.648	0.888
I closely follow the trends in current information technologies	2.45	1.644	0.913
Perceived information quality (IQ)			
Completeness (α=0.89, CR=0.790, AVE=0.558)			
The gamified IS provides me with a complete set of information	2.85	1.769	0.900
The gamified IS provides comprehensive information	2.44	1.712	0.826
The gamified IS provides me with the information I need	2.60	1.705	0.856
Format* (α=0.94, CR=0.834, AVE=0.703*)			

The information provided by the gamified IS is well-formatted	2.74	1.687	0.847
The information provided by the gamified IS is well laid out	2.47	1.459	0.697
The information provided by the gamified IS is clearly presented and concisely	2.17	1.262	0.807
Accuracy (α=0.703, CR=0.8050, AVE=0.592)			
The gamified IS produces correct information	2.32	1.356	0.775
There are few errors in the information I obtained from the gamified IS	2.81	1.679	0.698
The information provided by the gamified IS is accurate	2.53	1.438	0.832
Currency (α=0.913, CR=0.897, AVE=0.744)			
The gamified IS provides me with the most recent source of information	2.63	1.545	0.907
The gamified IS produces the most current information for our studies	2.36	1.484	0.891
The information from the gamified IS is sufficient and always up to date	2.48	1.480	0.944
Continuance-use aesthetic experience (AE)			
***Rewards* (α=0.95, CR=0.897, AVE=0.744)**			
The gamified IS offers me points as a reward for my activities	2.63	1.545	0.907
The gamified IS accumulate points I have gained	2.48	1.480	0.944
The gamified IS offers me more points when I try harder	2.36	1.484	0.891
***Competition* (α=094, CR=0.766, AVE=0.630)**			
The gamified IS makes me compete with my colleagues	2.48	1.480	0.944
The gamified IS makes it possible to compare performance with colleagues	2.20	1.570	0.916
***Self-expansion* (α=0.95, CR=0.724, AVE=0.501)**			
Using the gamified IS feels an increased ability to accomplish new learning ideas	2.65	1.601	0.917
I feel my activities result in learning new things when using the gamified IS	2.81	1.661	0.869
I feel that I have a larger learning perspective of what I am doing when using the gamified IS	2.64	1.601	0.917
***Meaning* (α=0.94, CR=0.850, AVE=0.784)**			
I feel my learning activities are very important to me when using the gamified IS	2.74	1.664	0.919
I feel my learning activities are personally meaningful	2.08	1.531	0.853
I feel I have a meaningful interaction with the gamified IS	2.61	1.604	0.855
***Continuance-use* (α=0. 89, CR=0.727, AVE=0.674)**			
Due to prompt feedback, I intend to continue using the gamified IS rather than discontinue regularly	2.63	1.877	0.904
I intend to continue using the gamified IS frequently in future to enhance learning interaction with the system and the instructor	3.01	1.992	0.955
I intend to use the gamified IS in my daily life activities	2.96	1.994	0.955

Note: *AVE – Average Variance Extracted, α – Cronbach's alpha, CR – Composite Reliability*

6.3.3.3 Discriminant Validity

To establish the discriminant validity, the Fornell-Larcker and Heterotrait-Monotrait Ratio were examined. As shown in Table 6.17, the latent construct better explained the variance of its indicator when compared with the variance of other latent constructs. Another measure of discriminant validity is the Heterotrait-Monotrait ratio which is shown in Table 6.18. An HTMT value close to 1 indicates a lack of discriminant validity. However, some scholars suggest a threshold of 0.85 or 0.90 to indicate discriminant validity. From Table 6.12, all the HTMT values did not exceed the 0.90 thresholds, implying that the various latent variables are distinct and different from each other (Kline, 2011).

Table 6.17 Fornell-Larcker Criterion

Constructs	Aesthetic experience	Information quality	IT capability	Continuance use
Aesthetic experience	0.826			
Information quality	0.573	0.921		
IT capability	0.817	0.716	0.907	
Continuance use	0.533	0.740	0.784	0.917

Table 6.18 Heterotrait-Monotrait Ratio (HTMT)

Constructs	Aesthetic experience	Information quality	IT capability	Continuance use
Aesthetic experience				
Information quality	0.687			
IT capability	0.891	0.855		
Continuance use	0.598	0.826	0.850	

6.3.4 Structural Model

After assessing the measurement model proved to be reliable and validated, this section focused on determining the structural model by assessing multicollinearity issues, model fit and predictive relevance, the significance of the path coefficient and estimations of the dimensions in the model.

6.3.4.1 Assessing Multicollinearity Issues

The variance inflation factor (VIF) index is used to assess multicollinearity. To avoid multicollinearity issues, a minimum threshold of 5 or lower is required. From the analysis in Table 6.19, the VIF score is between 1.00 to 2.185 and is below the suggested threshold estimate of 5 (Harter, Schmidt & Hayes, 2002). This shows that the problem of multicollinearity was an unlikely issue in this research.

Table 6.19 Multicollinearity Statistics (Inner VIF)

	Aesthetic experience	IT capability	Continuance use	Information quality
Aesthetic experience			2.185	
IT capability	1.000		1.419	
Continuance use				
Information quality		1.000	1.252	

Furthermore, the test for common method bias was conducted. To test for the presence of method variance bias at the individual-level of this study, Harman's single factor test was used. This approach is one of the most widely used tests by scholars (Podsakoff *et al.*, 2003). The study begins the test of common method variance (CMV) by entering all the variables into an exploratory factor analysis to examine the unrotated factor solution. No single factor emerged from the analysis or a factor explaining the majority of the total variance; no substantial amount of variation in the common method was present. Following this, multiple factors were revealed in the analysis and the first factor computed for only 30.88% of the total variance. Therefore, the analyses suggest that the common method bias is not significant in this study.

6.3.4.3 Assessing the Significance of Path Coefficient

To evaluate the significance of the path coefficient between the construct variables, a bootstrapping algorithm was run using 500 subsamples in SmartPLS. Figure 6.1 and Table 6.20 show the results of the structural model testing. The model shows the formative dimensions of

AE, the reflective dimensions of ITC, IQ, and CU, the explained variance (R^2), and the path coefficients. The full model explained around 74.3% of the variance in CU. The results as hypothesized proved that AE and ITC were positively related to CU of gamification. Particularly, the results indicated the path coefficient between the following: AE and CU (β= 0.402; t =2.750), perceived ITC and CU (β= 0.203, t=2.225) and perceived ITC and AE (β= 0.685, t=12.486) and perceived IQ and ITC (β= 0.813, t=24.350) are all significant at level 0.01. The insignificant path coefficient is between perceived IQ and CU (β= coefficient of β= 0.233 (t=2.548). Overall, the research model testing supported H1, H2, H3, and H5.

Table 6.20 Structural Model Results (Mean, STDEV, T-Values, P-Values)

Path	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	Results
Aesthetic_ => Continuance use	0.402	0.403	0.146	2.750	Supported
InfoQuality => IT capability	0.813	0.813	0.033	24.350	Supported
InfoQuality => Continuance use	0.308	0.311	0.186	1.653	Not supported
IT capability => Aesthetic	0.685	0.689	0.055	12.486	Supported
IT capability => Continuance use_	0.203	0.200	0.091	2.225	Supported

6.3.4.4 Assessing the Goodness of Fit and Effect Size

Similarly, the R^2 was used to assess the GOF. As stated earlier, the R square determination coefficient (R^2) varies from 0 to 1 and according to Henseler *et al*. (2009), the coefficient of determination is important in measuring the overall effect size and variance explained in the endogenous construct for the structural model. From the study, the R^2 value for continuance use is 0.731, indicating a substantial value accounting for 73% variation in the endogenous factors. The effect size is represented by *f2* as shown in Table 6.21. Effect size *f2* of less than

0.02 represents that there is no effect. However, .02, .15, and 0.35 represent small, medium, and large effect sizes (Cohen, 1988).

Table 6.21 Effect Size, f^2

	Aesthetic Experience	IT Capability	Information Quality	Continuance Use
Aesthetic Experience				1.009
IT Capability	1.257			0.224
Info Quality		1.696		0.065

Similarly, the Q^2 was examined as part of the effect size estimation through blindfolding cross-validation and synthesisation. The blindfolding process was run in SmartPLS to estimate the residual variance by assuming a specific number of missing cases. The Q2 value of continuance use is slightly different from the R2 value (0.731), indicating a high predictive relevance of the endogenous variables. The results of Q^2 are shown in Table 6.21.1.

Table 6.21.1 Q Square (Q^2)

Construct	Q^2 included	Q^2 excluded	Q^2
Aesthetic experience	1.86	1.239	0.334
IT Capability	1.86	1.10	0.406
Information Quality	1.86	1.86	
Continuance use	1.86	0.472	0.746

6.3.4.5 Estimation of the Dimensions in the Model

The study followed the three-step approach of Baron and Kenny (1986) in testing the mediating effects of ITC and AE. The first approach enabled the researcher to test the independent variables (ITC and AE) on the dependent variable (CU), which proved that both were significant (see Table 6.22). The results of the path coefficient for ITC on CU was 0.641 (t= 5.34). Secondly, the study proceeded to test the effect of AE (main) on CU, yielding a path coefficient of 0.496 (t=4.72). The effect of ITC on AE was tested; the results proved significant at 0.697 (t= 13.24).

Table 6.22 Estimation of dimensions in the model

Reflective measure	*Loading*	*t-value*
Perceived information technology capabilities		
Technical capability	0.64	14.23*
Behavioural capability	0.72	11.01*
Learning (Education) capability	0.61	4.72*
Perceived information quality		
Completeness	0.71	14.71*
Format	0.82	23.81*
Accuracy	0.21	1.71*
Currency	0.67	7.55*
Continuance use		
Continuance use 1	0.72	14.61*
Continuance use 2	0.81	31.02*
Continuance use 3	0.86	33.78*

Furthermore, in controlling the mediator, the third approach helped the researcher determine if the independent variable affected the dependent variable. The study showed that in partial mediation (testing the three variables together), the independent variables exerted a significant impact but with a diminishing effect. Thus, while other paths obtained significant predictions, the direct effect of ITC on CU diminished, indicating that the effect of ITC on CU is partially mediated by AE. Hence, the results showed that AE is a full mediator of perceived ITC.

Table 6.22 Estimation of dimensions in the full model

Formative measure	*Weight*	*t-value*
Continuance-use aesthetic experience		
Rewards	0.04	0.09^{ns}
Competition	0.21	1.62^{ns}
Self-expansion	0.53	4.89*
Meaning	0.68	8.34*

In contrast, the subsequent analysis focused on the relationship between perceived IQ and CU with perceived ITC as a mediator. As initially reported in the research model (Figure 2), the study found a non-significant relationship between perceived IQ and CU. The direct effect of IQ on CU was insignificant at 0.685 (t= 2.01). Hence, to find the direct path between IQ and CU, this study performed a product of the coefficient test approach to mediation. The extracted mediation standard error is 0.0284, whereas the coefficient between ITC and IQ and ITC and CU is 0.121. Combining the two (SE of the mediator and standard path coefficient), the standard mediation score is 3.0 at a 0.01 significant level.

In summary, two independent variables (AE and ITC fulfilled the condition) affected the CU of gamification – step 1; AE also mediated ITC, while ITC mediates IQ – step 2. Lastly, for full mediation to occur, the study did not expect a significant relationship to control for the mediator. ITC satisfies this condition while IQ does not. Accordingly, ITC is fully mediated by AE, and ITC partially mediates IQ. In general, the study results underpin perceived ITC as an intermediary from perceived IQ to CU in the gamified causal chain.

6.4 CHAPTER SUMMARY

This chapter highlighted the analysis and results obtained from the three study respondents (RO1 – 185, RO2 – 124 and RO3 – 133). The analysis and results were in relation to the proposed research models spanning the three theories underlying the research objectives. Descriptive statistics, cross-loadings and factor analysis, discriminant and reliability and structural model assessment were all presented.

CHAPTER SEVEN

DISCUSSION

7. OVERVIEW

The results of the study were presented in Chapter Six. The data were collected at three different points from student participants in a higher education institution in Ghana. The first study collected data from 185 student participants, the second from 124 participants and the third from 133 participants. A two-way structural equation model was followed to analyse the data. In this chapter, I first present a summary of the findings of the hypothesised paths for the research models. Then, I discuss the findings of this thesis in threefold - Section one discusses the adoption and acceptance of gamification in HEI. Section two discusses the learner engagement and motivation with GIS. Finally, I discuss the three antecedents of MOA in predicting the continuance use of GIS in education.

7.1 SUMMARY OF HYPOTHESIZED RESULTS

The current study developed and empirically tested a research model that provides a theoretical and practical understanding of gamification by examining the effect of gamified interactive systems in HEI in Ghana. To address RO1 the study extended the UTAUT model (Venkatesh *et al*., 2003) by applying institutional-based trust as a fundamental indicator of HEI in Ghana. In answering research question two, the self-determination theory (Deci & Ryan, 2000) was extended by adding game dynamics invoked by game design elements (rewards and competition), satisfaction and engagement. As such, eight hypotheses were deduced. To address the last RO, the proposed model extended the MOA framework (Maclnnis *et al*., 1991) to investigate the effect of aesthetic experience, information technology capability, and information quality on the continual use of gamification. The study proposed seven hypotheses; *see Chapter five for the results.* Also, eight hypothetical paths were analysed based on the

moderating roles of gender and age within the UTAUT constructs. Out of the eight, only three had a significant influence on gender and age (see Table 6.7.1).

Primarily, the results of research question one support the hypothesis relationship among the constructs, and students were receptive to the idea of adding game elements into learning and teaching in HEI in Ghana. Even though most of the constructs have not been previously tested in HEI in Ghana, the results proved definite for implementing gamification. In answering research question two, all but two hypothesised paths were insignificant. Specifically, the results suggest that intrinsic motivation (course satisfaction) influences gamification outcome (learning engagement) in a gamified learning environment, and also self-determination (autonomy and social relatedness) influences course satisfaction. However, self-determination (competence) was found not to influence course satisfaction, which was contrary to previous findings and literature.

Lastly, the third research question found a positive relationship between continuance use aesthetic experience, information capability and continuance use of GIS. However, no relationship was found between information quality and continuance use. Further, the mediation role of IT Capability, CU Aesthetic Experience and Continuance use, and the mediating role of Information Quality, IT Capability and Continuance use were confirmed. The results are summarised in Table 6.1, and further discussions follow.

Table 7.1 Summary of Hypothesized results

Hypothesized path	Results
Acceptance of Gamification – aligning UTAUT model	
H_1 Performance expectancy →Behavioural intention	Supported
H_2 Effort expectancy →Behavioural intention	Supported
H_3 Attitude →Behavioural intention	Supported
H_4 Image →Behavioural intention	Not Supported

H_5 Trust →Behavioural intention	Supported
H_6 Facilitating condition →Behavioural intention	Not Supported
H_7 Social influence →Behavioural intention	Supported
H1a: Performance expectancy*Age → Behavioural intention	Supported
H1a: Performance expectancy*Gender → Behavioural intention	Not Supported
H2a: Effort expectancy*Age → Behavioural intention	Not Supported
H2a: Effort expectancy *Gender → Behavioural intention	Not Supported
H3a: Social influence*Age -> Behavioural intention	Supported
H3a: Social influence*Gender -> Behavioural intention	Supported
H4a: Facilitating conditions*AGE -> Behavioural intention	Not Supported
H4a: Facilitating conditions *GDR -> Behavioural intention	Not Supported
Learner Engagement through Gamification – aligning SDT	
H_1 Autonomy → Course Satisfaction	Supported
H_2 Competence → Course Satisfaction	Not supported
H_3 Competition → Competence	Supported
H_4 Competition → Relatedness	Supported
H_5 Course Satisfaction → Engagement	Supported
H_6 Relatedness → Course Satisfaction	Supported
H_7 Reward → Autonomy	Supported
H_8 Reward → Competence	Not supported
Continuance use of Gamification – aligning MOA	
H_1 Continuance use aesthetic experience→ Continuance use (CU)	Supported
H_2 Perceived IT Capability → Continuance use	Supported
H_3 Perceived IT Capability → Continuance use of aesthetic experience	Supported
H_4 Perceived Information Quality → Continuance use	Not supported
H_5 Perceived Information Quality → Perceived IT Capability	Supported
Identified Relationships: Continuance use of Gamification	**Mediation type**
H_6 IT Capability → CU Aesthetic Experience → Continuance use	Full mediation
H_7 Information Quality → IT Capability → Continuance use	Full mediation

7.2 ACCEPTANCE OF GIS (LEARNER CHARACTERISTICS)

The study explored students' level of acceptance of gamification integration into existing LMS - Sakai. The acceptance of gamification was more than neutral, as indicated by the students of UNI-GAMI. Previous studies (Filippou *et al*., 2018) interestingly found similar findings on the acceptance of gamification prompting the need to focus on ***learner characteristics***.

Rooted in the UTAUT model and prior research on technology adoption, the results found a direct effect of PE, EE, AT, IM, and TR on BI- which implies a strong indication of technology acceptance. This confirms users' views on 1) how gamification can improve studies and 2) how the skills developed using LMS and playing computer games equips them to use gamification. Measurement item 4 of effort expectancy reveals that 87.6% of the users find gamification easy to use, based on their computer game skills and use of LMS. It is of interest to know that the students (56.2%) declined the indication that those using gamification are getting an improved education and social capital than those not using. The perspective does not confirm Moore and Benbasat's (1991) view on the image (social status) as one of the key indicators when adopting an innovation. The results suggest an unfavourable outcome with the average ratings of predictors of the image construct. Another interesting finding was that social influence (my colleagues will like it if I choose to learn with games) had no relationship with eight of the variables but with image. However, facilitating conditions had a significant association with effort expectancy, attitude, and image, wherein facilitating conditions were operationalised as a specific unit in place to assist students with technological problems they may encounter. Students who reported that their familiarity with games would equip them in using other added features as game elements also have a positive attitude and perception toward gamification. However, there was a negative relationship ($r=-.2.3$, $p<.01$) between students' use of LMS (use behaviour) and how adding gamification would motivate learning and encourage the use of the gamified system (performance expectancy). Thus, a student's familiarity with a particular

technology and appreciation of innovation does not necessarily confirm the acceptance of the use of the innovation or added features to the system. Previous studies showed that perception, demographic variables, and associated variables had an impact on the development, application, and use of gamification factors. This study, similar to Featherstone and Habgood (2019), showed that experience with games contributes to players' interest to use game design elements in learning and can improve students' grades if the experience of the elements is more compulsive in the gamified system.

Furthermore, previous research has revealed the dominance of males in playing games. Recent empirical research (Seabon *et al.*, 2015) supports this claim and found that female students are less interested in games than males. In contrast, this study found that female students' interest in games was just, if not more, as engaging in games and gamification learning as males.

Extant research in gamification (Filippou *et al.*, 2018) has found that users' experience with computer games and technology in learning directly impact the acceptance of gamification. This research shows a mixed relationship between use behaviour (Sakai) and acceptance of gamification. Whereas there was no relationship between familiarity and attitude and image, there was a negative relationship between performance expectancy and effort expectancy for accepting gamification in learning. However, there was a strong positive relationship with facilitating conditions. Therefore, the study concludes that a student's familiarity (facilitating condition) with technology does not guarantee the acceptance of adopting gamification in learning. Future studies may seek to understand an individual's familiarity with technology before adding a new feature to decide on the adoption of GIS within the Ghanaian educational system.

In exploring gamification integration in existing LMSs, the researcher included system quality as a new construct to ascertain the acceptability of gamification in Sakai. Interestingly, there

was a negative relationship between system quality defined as attractiveness, organisation, and availability of Sakai to students' performance expectancy and effort expectancy. Additionally, there was no relationship with performance expectancy. However, there was a strong relationship with attitude, facilitating conditions, and familiarity with technology to suggest the tendency of gamification adoption by designing an organised, attractive system and making it readily available. Based on this finding, the study concludes there is uncertainty with the student's decision to adopt gamification as contingent upon the system quality. Future research may explore the negative ratings to understand students' system quality experience with the design, organisation, and availability of LMSs in adopting gamification.

Moreover, the findings indicate that the majority of the students play puzzle and adventure games, with only 4.9% of the students playing shooter games. Interestingly, 90.8% of the students play computer games. These statistics support the earlier assertion that students enrolled in IT professional courses are likely to play computer games. The results show a high level of access to technology devices available to the students. With regards to the Sakai LMS usage, the majority of the students, on average, login less than once a week while 29.7% of students login about once each week when school is in session. The majority of the students have less than one year, or between 1-3 years of experience (77.3%) in using LMS. Also, the majority of the students on average, spend between 31 and 45 minutes on UNI-GAMI LMS. These statistics support the assertion that students' prior knowledge of technology is a boost to encourage innovation since LMS requires basic IT skills (web browsing, watching online videos).

Recent studies indicate that game design elements are transformative and serve as a motivational strategy in teaching and learning in higher education (Nousiainen *et al*., 2018; Hanus *et al*., 2015). However, this current study indicates low knowledge, use, and uptake of

gamification in learning by students. A restraining factor for students' acceptance and use of gamification is the limited access to these innovations at the university. Higher institutions, therefore, need to effectively integrate various learning (formal or informal) strategies to enable students to identify their learning habits. Through this, the different learning habits of students can be known via an experiment when adopting future learning strategies for educational institutions.

In conclusion, compared to the UTAUT model, this research categorised the significant factors into three typologies necessary for explaining behavioural intention and technology acceptance. The results from this study proved that two constructs (PE and EE) of the original UTAUT model may be considered as *technology and learner attributes*, while the remaining two (SI and facilitating conditions FC) may be considered as *institutional factors* or *outcomes*. A significant omission and less reliance in the conceptualisation of the original UTAUT model is the institutional-based trust (TR) and attitude (ATT). However, these factors produced a substantial improvement in the variance explained in technology acceptance and behavioural intention. Importantly, the extensions (TR and ATT) formed the new *psychological safety factors* in the UTAUT model and serve as the necessary conditions for the uptake of information systems in developing economies.

7.3 ENGAGEMENT AND MOTIVATION (LEARNER OUTCOMES)

This study examined how game design elements supported and enhanced students' basic psychological needs in learning and further clarified the role of autonomy, competence, and relatedness. Rooted in the self-determination theory and prior research on game dynamics induced by game elements, the impact of PBL, in terms of rewards, competition, and need satisfaction on course satisfaction in the process of student engagement (gamification outcome) was also examined. The researcher found that the results provide support for game dynamics

induced by rewards systems (PBL) and need satisfaction (autonomy), but not competence, as well as the direct effect of autonomy needs satisfaction and intrinsic motivation (course satisfaction). As expected, intrinsic motivation (course satisfaction) and gamification outcome (learning engagement) were positively associated with the gamified system. This result which resonates with the importance of ***learner outcomes*** is consistent with Kim *et al*. (2012) and Huang and Cappel (2005), who contend that game players fancy entertainment, autonomy and fun as the primary motivation for playing games. People engage in or play games to seek pleasure.

Additionally, the data suggested that competition in a gamified environment contributes to the competence of gamified use but not the course satisfaction of use. Concerning need satisfaction, students' relatedness with peers contributed to the course satisfaction of gamification, and competition was found to be positively associated with social relatedness. The novel contribution of this study to the use of gamification, specifically in computing education, is the instructional strategy that it offers the students. In this regard, the gamification elements revealed the active-centred learning focus on the student, promoting personal learning experiences with game elements. The gamification elements also allowed students to practice computing education competencies (competitive) in a realistic environment through the simulation of real-life experiences while keeping them engaged with the game design elements.

It should be noted that the insignificant relationship between competence and enjoyment may be due to the scarce gamified resources in the academic environment to train students for future paid-off benefits, especially for the advancement of intrinsic gamified motivation. Although relatedness influences intrinsic motivation when students engage with and have similarities to learners on a gamified platform, there is a likelihood of learning pleasure from the use of gamification usage. In other words, quality relatedness with game design elements

(competition) also predicts quality relatedness with the students undertaking the course. Also, considering that autonomy influences course satisfaction indicates that learners have a sense of voluntary interaction or the willingness to be unpressured to engage in GIS. In turn, it may lead students to experience a high level of gamification pleasurable use. This view is consistent with SDT in that; autonomy is predicted to redeem the internalisation process. Thus, motivation transcends from external to internal to understand volitional forms of motivation in the context of games and user learning engagement (Deci, 1999; O'Brien & Toms, 2008).

Further, this thesis supports the assertion that autonomous motivations are likely to be aroused by game elements among students because the students feel their basic psychological needs are championed. According to the data, satisfaction with all three psychological needs was positively associated with intrinsic motivation. Thus, it was found that students have a feeling of autonomy, social relatedness, and competence, a finding that is consistent with Sailer *et al*. (2017) and van Roy and Zaman (2019). To avoid the pitfall of basic psychological need support (diminishing feelings), this study adopted Ryan and Deci's (2000c) view that the satisfaction of all three needs should be aligned together and that educators should align the game elements to fit the group, rather than for students' need satisfaction. For instance, using the predictive behaviour of the coefficient of determination R^2, the students were more aligned to the autonomous feelings (31.3%) of the gamified system than to competence (23.9%) or relatedness (14.7%). The influence of autonomy was stronger than that of competence and social relatedness, which is not surprising since SDT asserts that autonomy is the most essential in terms of intrinsic motivation (Sørebø *et al*., 2009). This shows that students have higher preferences towards some game elements invoking basic psychological needs than towards others. According to Deci and Ryan (2008), the weight that individuals assign to different needs is not surprising since people have personal, cultural and contextual contributing factors to innate psychological needs.

This study further showed that merely providing students with reward systems, such as PBLs, does not necessarily lead to user competence. Thus, the findings highlight the eschewing views that 1) when rewards improve students' self-efficacy or personal learning competence, their intrinsic motivation may increase and that 2) rewards may decrease when they cause students to attribute their behaviours to external rather than internal sources (Ng, Sorensen & Eby, 2006). To this end, rewarding students in a gamified system should be contingent on the activities they engage in, such as group discussions, responding to instructor feedback and participating in quizzes. Importantly, *feedback, interactivity and aesthetic appeal* were identified as positive elements for maintaining and inciting engagement. According to these findings, rewards may contribute to competence when instructors subject rewards to the attainment of certain levels of task performance or assignment. Supporting this view, Deci (1975) stated that:

> *"……. rewards that are contingent on performance levels should have the stronger undermining effect since such rewards strongly imply to individuals that they engage in behaviours to attain rewards, rather than because the behaviours are of intrinsic interest."*

Interestingly, the data in this study showed that 33.7% of the variance in explaining enjoyment is determined by the three-psychological-needs perspective: autonomy, competence, and relatedness. Thus, individuals are intrinsically motivated when their psychological needs are fulfilled. This confirms 1) the notion of self-determination and 2) the finding that adding game elements (satisfaction) to educational systems may result in needs satisfaction for students. The researcher also found that merely increasing the fun aspect (hedonic value) for students' gamified involvement without considering their basic psychological needs may lead to a less successful engagement with the IS. Therefore, educators should take some steps to meet the student's self-determination requirements (to increase and not reduce enjoyment) for a

successful academic journey. This finding is consistent with the results of Suh, Wagner, and Liu's (2018) study, who according to their findings, suggested that it is not recommended to overlook any of the three abovementioned psychological needs determinants. Accordingly, ignoring any of these three determinants will significantly reduce satisfaction, which may, in turn, reduce the levels of user engagement with gamified IS.

Given the above results, it can be argued that effective learning support strategies are those that address the issue of students' autonomy, competence, and relatedness in the gamified environment. Several types of literature on gamification in education have been proposed to support gamified learners. For example, educators can provide specific PBL or game elements to improve cognitive and behavioural engagement (Hew *et al*., 2016) and design collaborative and interactive learning activities that increase motivation, improve learners' confidence, and reduce disconnection from gamified IS (Barrio *et al*., 2015) and flexible learning options. Therefore, to promote students' self-determination and support for SDT-based learning strategies, Reeve (2002) argued that (1) students should be provided with a meaningful justification as to why a lesson or assignment or a particular lifestyle is relevant or essential to their well-being (2) there should be an interpersonal relationship based on flexibility and choice rather than on pressure and control; and (3) it is important to acknowledge the negative feelings associated with participating in a challenging (arduous) activity.

7.4 CONTINUANCE USE BEHAVIOUR

The primary intent of this study is to address the need for an integrative model that explains the factors leading to a ***learner's continuance use behaviour*** in an IT educational context. Focusing on aesthetic appeal and the MOA theoretical framework, the study examined the impact of AE (motivation), perceived ITC (opportunity), and perceived educational IQ (ability) on gamification continuance. In a nomological sequence of the network, the study positioned

the learner's CU in O→A→M order, which is essential for future educational research and practice. The following are the contributions of the study.

First, the experience of perceived information technology capability and continuance use of aesthetic experience was found to have significant positive effects on continuance use of the gamification system in education. The results indicate that: 1) the more capable (skills) the users are towards using the gamified system, and 2) the more the users feel the aesthetic experience of the system, the more likely they will perceive engagement and motivation with the system and intend to continue using the technology.

As stated earlier, the study found intermediate relationships among the factors (MOA). Precisely, the hypothesis found central roles of AE and perceived ITC and positioned the relational order as O→A→M. The results, therefore, pointed to the value of aesthetic experience and perceived ITC as an antecedent to gamification continuance use, for example, for the learners of the GIS (M-Learn!). Additionally, in predicting CU, the researcher found the motivation factor (aesthetic experience) to play a vital role, which is consistent with previous studies. Though supporting the previous nomological order of the factors (see Wang & Noe, 2010; Kettinger *et al*., 2015), the study suggests future research to explore the relational variables and directions in other contexts.

Second, the results largely confirmed the hypotheses drawn from prior motivational systems research on the continuance use of technology. The method positioned AE as a higher order, leveraging classroom perception practices that will encourage the continued use of GIS. AE and Perceived ITC were found to predict CU of gamification positively. The proposed effect of perceived IQ on CU, however, was not supported. Instead, perceived IQ had a positive relationship with perceived ITC about AE. Interestingly, this study is the first to incorporate the aesthetic experience into the CU of gamification in education. Arguably, no previous

research in IS has developed, empirically tested, and validated a new AE construct learner-level variable. This study, therefore, supports and extends prior work on aesthetic experience on CU with game design elements (Hofacker *et al*., 2016; Suh *et al*., 2017).

Third, the study found a significant effect of rewards, self-expansion, and meaning, but not competition. According to Hair *et al*. (2011), the potential reason for the difference is due to the absolute importance of the indicators. From the analysis, only the loadings of self-expansion (0.674) and meaning (0.828) were salient while rewards and competition were not (0.088 – 0.246), even though each sub-dimension of the AE construct had significant loadings.

With the assessment of the latent AE constructs, the reflective indicators (weights) proved important (Hair *et al.*, 2011), especially when loading the low values - competition and rewards (i.e., 0.088 and 0.192 respectively). Although previous studies have investigated the importance of competition in fostering feelings of relatedness (Carr & Walton 2014; Sailer, Hense, Mayr & Mandl, 2017; van Roy & Zaman, 2019), the measure of competition lacked relative importance. Hence, this study found that in a typical gamified learning environment, competition is not salient as compared to the student's increased ability to accomplish new learning ideas (Self-expansion). The study, therefore, suggests that educationists prioritise less on making the competition a salient component of the "learning game," e.g., associate a part of the course grade or extra credit directly to the result of the ranking of a game outcome and encourage group competition rather than individual competition.

The motivational powers of rewards in education were brought to question as meaning and self-expansion weighted more to students who felt that learning activities are of personal meaningfulness. The result of the rewards was surprising. Compared to previous studies, the measuring items (only 3) could account for their weak effect on the AE construct. As shown in

Table 5, the weight of the rewards produced a marginal significance, which indicates its role in facilitating CU, even though its significance is less compared to self-expansion and meaning.

Notwithstanding the positive results of gamified rewards in education and learning (see Mekler *et al*., 2017; Sailer *et al*., 2017), this study calls on future research to 1) investigate other compelling constructs or elements or refine the measuring items that have personal meaning to students in CU since rewards may be short-term or fade out (Magni, Taylor & Venkatesh, 2010) and; 2) for continuance use of gamification, what type of game design elements best motivate the learner. In conclusion, when the researcher modelled AE with its sub-dimensions, it explained 52% of the variance in CU in the structural model compared to 73%. Thus, sub-dimensions of the AE are determined by their relative weights.

The results support the mediating effect and direct motivation of aesthetic experience in CU in education. A positive CU experience includes activities that result in students learning new things and an increased ability or broader perspective of what is at stake for them (i.e., self-expansion). Additionally, it indicates that a student can perform well when he/she has a meaningful interaction with the gamified system and considers the gamified learning activities as personally meaningful (i.e., meaning).

Insight on an integrated model

Based on the analysis of the results on how the concept of gamification can help to bridge the lack of an integrated framework, three clusters were identified: *Learner characteristics, Learner outcomes (critical decision stage) and Learner continuance behaviour.* This insight, developed in a post-study framework and a conceptual model (discussed in the next chapter) integrates the three boundary conditions for higher education sector decision-making about how to implement innovation into existing technologies: Acceptance, Motivation, Engagement and Continued intention to use.

7.5 CHAPTER SUMMARY

As highlighted in Chapter one, this chapter discussed the data analysis outcomes to address the three research questions. The chapter first commenced with a summary of the hypothesised paths and outcomes to set the premise for discussion. Three separate discussions were then followed to answer the three research questions. The discussions highlighted the adoption and acceptance of gamification in HEI in Ghana, user engagement and satisfaction of GIS (aligning the SDT perspective) and the mediating role of continuous use of aesthetic experience, information technology capability and information quality towards continual use of gamification. The three theories for the study (UTAUT, SDT and MOA) were all found to provide justification for understanding gamification outcomes for the study. The next chapter will highlight and assess the approaches used and detail the reflection on the thesis so far, with a contribution to theory development and recommendation for future research.

CHAPTER EIGHT

CONTRIBUTIONS, REFLECTIONS AND CONCLUSION

8.1 OVERVIEW

This thesis exposed the limitation of a single theory for addressing acceptance, engagement and continuance use intention and proposed three conceptual frameworks for tailoring gamification to students (achiever gamer players) in higher education. The conceptual frameworks were based on three large-scale studies on determinants of adoption, motivation and engagement and continuance use of GIS. To establish the feasibility of the model, I evaluated one learning management system and two versions of a GIS to motivate learning attitudes in players. The results of the evaluation presented in Chapter 6 reveal the acceptance of gamification in education and the effectiveness of gamification in motivating and engaging players with self-determined determinants like autonomy, competence and relatedness. In this chapter, I first present a summary of the findings and reflections on theories, methods and conceptual framework. Finally, I present the HEI-Gamification Configuration (HEIGC) to address the lack of an integrated framework for tailoring GIS in this dissertation based on three clusters: *Learner characteristics, Learner outcome (critical decision stage) and Learner continuance behaviour.* I conclude with some insights from Ghana on the Covid-19 pandemic and the way forward in higher education.

8.2 RESEARCH SUMMARY AND MAJOR FINDINGS

The purpose of this study was to develop a practical and theoretical understanding of gamification and its antecedents of continuous use of gamified interactive systems in teaching and learning in a higher education institution. To accomplish the above purpose, the study identified three research objectives, which are stated as follows. The RO1 defined and explored gamification in higher education settings in Ghana. The RO2 emphasised how gamification

supports students in higher education in their basic psychological needs. Consistent with the self-determination theory, the study examined how game dynamics evoked by rewards and competition motivate students' engagement and satisfaction with GIS (Suh *et al*., 2017; van Roy *et al.*, 2019). To this end, the study became imperative to focus on sustaining user engagement; hence RO3 examined the three antecedents of the motivation-opportunity-ability perspective in predicting the continued use of GIS in higher education institutions in Ghana.

To address the stated objectives, the study began by conceptualising and framing gamification research in Chapter Two. Since gamification is a new concept, the chapter discussed the definitions and conceptual approaches (theoretical and frameworks) underpinning gamification research and the development and use of gamification, the application of gamification, and the impact of gamification on user behaviours. Gamification in this thesis was defined as the use of game design elements (applying the elements to a target system) in non-game contexts to enhance and motivate users. Thus, gamification use game elements to execute functions of academics in dealing with students-instructor motivation to solve problems and promote desired learning behaviours.

The thesis further identified essential perspectives and constructs underlying gamification research. Concerning RO1, the constructs began by examining how users *accept* specific information systems based on the works of the UTAUT model. However, in measuring IS success, IS adoption is just the first initiation towards complete success. Hence, the study moves further by studying how users can be engaged in a gamified system by applying the self-determination theory. The last constructs examined the post-adoption behaviours of students by highlighting IS continuance and the behavioural patterns that reflect the continued use of gamification in education. The constructs reviewed in the chapter include GIS adoption, engagement and continuance behavioural change.

After establishing the basis of gamification research, the next chapter (two) reviewed gamification in higher education in developing economies. The chapter presented the game elements and its associated outcomes such as engagement, motivation, and learners' performance. The dominant game elements in teaching and learning in developing economies were presented as levels, points, badges, leaderboards and storyline. The chapter also identified research gaps for future research. The identified gaps in literature aligned with two main themes: Adoption of GIS and theoretical and methodological agenda. Further, the review on gamification shows that several factors must be considered when deploying gamification in developing economies, such as the proposed gamification research framework.

Subsequently, based on the literature review and tenants of adoption, psychological need for gamification and post-adoption behaviours (continuance) experienced by users in the GIS, Chapter Four presented the three theories underlying this study. Namely, the unified theory of acceptance and technology use, self-determination theory, and motivation-opportunity-ability theory. The UTAUT aid in motivating the progressive development of gamification in higher education institutions and schools and is extensively used by researchers in Educational Technology research. The self-determination theory describes a set of psychological needs whose satisfaction is an intrinsically motivating source of action, which provides energy for individuals to act on their environment and to manage their behaviours in a self-determining fashion (Deci & Ryan 1985, p.4). It suggests the need (psychological) for autonomy, competence, and social relatedness. Concerning the MOA, the framework played a vital role in understanding human behaviour and work performance, particularly applying all three factors (motivation, opportunity, and ability), which are antecedents to action and interrelated behaviour in the gamified system (Maclnnis *et al*., 1991).

Through the theories' discussion, several gaps were identified under each section, some of which this study addressed by proposing a conceptual framework *(see figures 4.1, 4.2, 4.3 and 4.4)* for this thesis in Chapter Four. The framework examined the association between 1) performance expectancy, effort expectancy, social influence, facilitating condition, attitude, trust, image and behavioural intention to use gamification; 2) game design elements, need satisfaction, intrinsic motivation (course satisfaction) and learning engagement; and 3) aesthetic experience, information technology capability, information quality and IS continuance. The relationship between the UTAUT constructs was outlined in seven (7) hypotheses, that of SDT was outlined in eight (8) hypotheses, and the MOA framework was outlined in seven (7) hypotheses.

The context of this study, namely Higher Education Institutions in Ghana, was presented in Chapter six. The Chapter discussed HEI in Ghana, why the study chose UNI-GAMI, an overview of teaching, learning and technology use in higher education and a general overview of gamification in education in Ghana. The majority of the HEI in Ghana have launched LMSs to facilitate teaching and learning. These traits of online presence in teaching and learning necessitated the need to examine the application of game elements integration in LMSs or the adoption of game designs in classrooms in Ghana.

Chapter Five presented the methodology employed to test the hypothesis. By adopting a positivist stance, a quantitative research method was the most appropriate for this thesis. The study administered 442 (185+124+133) questionnaires to students in UNI-GAMI in three different departments. An Exploratory Factor Analysis and Structural Equation Model (two-stage approach) were used in the data analysis.

Consequently, Chapter Six presented the analysis and results obtained from the respondents. The results were classified into three, such that each result addressed a research question and

the proposed hypothesis. The chapter presented the descriptive statistics, cross-loadings and factor analysis, discriminant, and reliability tests.

Table 8.1 Research Questions and summary of Major Findings

Research Objective	Summary of Major Findings
Defining and Exploring gamification in HEI	
Research Objective 1 •To explore students' gaming experience, perception and acceptance of adding game design elements to teaching and learning in higher education institutions in a developing economy (evidence from Ghana)	Rooted in the UTAUT model, the study found that performance expectancy, effort expectancy, attitude, and social influence are antecedents to students' acceptance of gamification in learning in higher education institutions in Ghana. The results from this study proved that two constructs (PE and EE) of the original UTAUT model may be considered as *technology and learner attributes*, while the remaining two (SI and FC) may be considered as *institutional factors or outcomes* that influence students' behaviour. Trust and attitude are considered the *psychological safety factors* in DE. **Performance expectancy and Behavioural Intention** Performance expectancy has a positive association with behavioural intention on students' readiness to accept gamification in learning. This presupposes that how students perceive that gamification would improve their learning and encourage interactive learning with their colleagues is an antecedent to adopting an innovation. **Effort Expectancy and Behavioural Intention** Effort expectancy has a positive association with behavioural intention on students' readiness to accept gamification in learning. This indicates that for potential users to accept innovation, the perception is that learning with the gamified system should be easily based on their skills. **Attitudes and Behavioural Intention** Since attitude is high, there is an influence on students' behavioural intention to use gamification in learning. Students in HEI are the emitting signal which indicate acceptance of innovation through their attitudes and beliefs. Thus, the student's perception that gamification is an excellent idea to boost learning and should be encouraged in higher education or universities would only promote readiness for the system use. **Social Influence and Behavioural Intention** Social influence has a significant influence on students' behavioural intention to use game design elements in learning. This implies that students' increased perception (favourable) of using games in learning as supported by their peers would increase their prospects of using game design elements. **Institutional-based Trust and Behavioural Intention** In contributing to the UTAUT model, the study proposed and tested the institutional-based *Trust*, i.e. how students perceive UIN-GAMI internet as trustworthy or the UNI-GAMI ICT in hosting gamification services. The results indicate that Trust is positively associated with students' behavioural intention to use gamification in learning. The direct effect on the user's intention to use game elements is an indication that trust imposed on an institution's infrastructure, management and

	personnel of educational technology is essential in explaining the readiness and acceptance of innovation. Concerning image and facilitating conditions constructs, the study found an indirect association with students' intention to adopt gamification. Further, experience with games contributes to players' interest to use gamification in HEI. It can improve students' grades if the experience of the game design elements is more compulsive to learning. Female students in HEI tend to be interested in games just, if not more, in intending to engage in gamification learning than males. ***New finding*** – The perception of digital games in learning was seen as a distraction at DE university. For e,g, a computer lab had a '*no playing of digital games in the lab'* label. ***Major Contribution*** • Arguably, this is the earliest cited study on gamification in developing economies with 28 citations *(see Google Scholar and ResearchGate)* as of May 2022. The study further adds to the existing knowledge regarding technology-enhanced learning in developing economies. • Furthermore, considering the few studies on game and gamification teaching and learning in developing economies, this study responds to the gaps identified in the literature.
User engagement with gamified information systems in education	
Research objective 2 • To determine how gamification supports students in higher education in their basic psychological needs (aligning the self-determination theory)	**Need Satisfaction (autonomy) and Learning Engagement** The study found a positive impact of autonomous activities on user engagement with a gamified system based on the self-determination theory. This presupposes that when users have an increased take or decision (freewill) in the gamified activities on the platform, their level of engagement with the system increases, which promotes individual learning. **Need Satisfaction (competence and relatedness) and Course Satisfaction** Students' course satisfaction is not affected by competence, implying that competence does not necessarily influence students' gamified course satisfaction to pursue learning engagement with the gamification application in HEI in Ghana. The insignificant relationship between competence and course satisfaction may be due to scarce gamified resources in the academic environment to train students for future paid-off benefits, importantly, to advance intrinsic gamified motivation. Further, there was a positive influence of social relatedness on course satisfaction which implies that students' relatedness with peers in gamified learning contributes to the course satisfaction of gamification. **Game Dynamics (competition) and Need Satisfaction (competence and relatedness)** Competition has a significant influence on need satisfaction (competence) in HEI use of GIS. This presupposes that competition or challenges in a gamified system would propel them to improve their competence in attaining the badges or leading the leaderboard. For example, if student A is ranked or displayed as the top scorer on the leaderboard for a particular course, students in the class would seek to improve their skills to challenge the top position, thereby increasing their performance and competence. This implies that students who want to attain the reward might have to put in extra effort to top the leaderboard and receive the trophy (badge). Similarly, competition has a significant influence on social relatedness.

	Thus, leaderboards may create social pressure when there is intense competition for the top spot, which increases system engagement and social relationships with the players. **Intrinsic motivation (course satisfaction) and Learning Engagement** The relationship between intrinsic motivation (i.e., course satisfaction) and gamification outcome (i.e., engagement) was found to be significant. This relationship indicates that game players fancy entertainment or fun as the primary motivation for playing games, and people engage or play games to seek learning or task pleasure. **Game Dynamics (Rewards) and Need Satisfaction (Autonomy and Competence)** Digital Rewards offered to students on successful completion of a task are not affected by the skills or competence of the students; however, the direct effect of rewards on autonomy is confirmed. From literature, these findings highlight the eschewing views that 1) when rewards improve students' self-efficacy or personal learning competence, their intrinsic motivation may increase, and 2) rewards may decrease when rewards cause students to attribute their behaviours to external sources rather than internal. In conclusion, the study found that simply increasing the fun aspect (hedonic value) for students' gamified involvement or engagement without considering their basic psychological needs may lead to a less successful engagement with the gamified IS. Therefore, educators should put steps in place to meet the student's self-determination requirement (to increase and not reduce satisfaction) for successful learning. ***Major Contribution*** • This is the first study to be carried out on the effect of gamification on course satisfaction and user engagement in a gamified system. • Additionally, extant literature has largely focused on applying SDT to other learning educational technologies. This study presents success in applying SDT in unravelling gamification potential in education in developing economies. Arguably, this is the first study to explore the interrelationship between game elements needs satisfaction, intrinsic motivation, and gamification outcomes
Continuance use of gamification in education	
Research objective 3 • To determine how learner's aesthetic experience, information technology capabilities, and information quality contribute to continuance use of gamification in education (aligning the	The experience of perceived information technology capability and continuance use of aesthetic experience was found to have significant positive effects on continuance use of gamification system in education. The results indicate that: 1) the more capable (skills) the users are towards using the gamified system and 2) the more the users feel the aesthetic experience of the system, the more likely they will perceive engagement and motivation with the system and intend to continue using the technology. There was also an intermediate relationship among the factors (MOA). Precisely, the hypothesis found central roles of AE and perceived ITC and positioned the relational order as O→A→M. The results, therefore, pointed to the value of aesthetic experience and perceived ITC as an antecedent to gamification continuance use, for example, for the learners of the GIS (M-Learn!).

MOA theoretical perspective)	Additionally, in predicting CU, the study found the motivation factor (aesthetic experience) to play a vital role consistent with previous studies. Though supporting the previous nomological order of the factors (see Wang & Noe, 2010; Kettinger *et al.*, 2015), the study suggests future research to explore the relational variables and directions in other contexts. Thus, in a nomological sequence of the network, the study positioned the learner's CU in O→A→M compared to the original causal link M→O→A, which is essential for future educational research and practice. The results also support the mediating effect and direct motivation of aesthetic experience in CU in education. A positive CU experience includes activities that result in students learning new things and an increased ability or broader perspective of what is at stake for them (i.e., self-expansion). Additionally, it indicates that a student can perform well when he/she has a meaningful interaction with the gamified system and considers the gamified learning activities as personally meaningful (i.e., meaning). ***Major Contribution*** • Arguably, this is the first study to apply the Motivation opportunity Ability theory to gamification in education. • Similarly, this is the first study to position the learner's continuance use of educational technology in O→A→M compared to the original causal link M→O→A.

8.2.1 Summary of findings on the HEIGC Model

The evaluation of the HEIGC model (see page 170) for game design elements highlight some advantages to higher education in behaviour change. The following highlights key benefits of promoting GIS in developing economies' education.

- Tailored game design elements in target systems are more effective than one-size-fits-all learning management systems for motivating and engaging intention, abilities, and attitudes.
    - A tailored gamified IS inspires a better play experience which may lead to engagement.
- Gamification designers in HEIs in DE do not need to blend different strategies in a single gamified IS to make it motivating, engaging and effective. Using the recommended game design elements identified in this thesis (points, badges,

leaderboards, and competition), herein referred to as 'single appropriate strategy' could be motivating and engaging.

- The competition strategy when assembled with other variables such as rewards, self-expansion and meaning did not yield a positive influence on learners. As such gamified IS employing competition may not effectively promote desired behaviour change in education.
- Higher education, educators and providers of technology services in HEIs do not need to develop a fully-fledged gamified system from scratch for the target students. Tailored experience can be achieved by integrating the recommended and appropriate gamification strategies and elements into existing learning management systems.
- The HEIGC framework provides an effective guideline for tailoring gamification to players to increase the motivation and engagement level of learning and teaching management systems by integrating the appropriate determinants.
    - The HEIGC framework highlights guidelines, strategies and determinants that are validated by student participants and therefore should be reinforced for learners of IS (gamified) in DE.

8.3 REFLECTIONS

The importance of this section is to reflect on the approaches and procedures adopted in this thesis to address the research problems and objectives. The three areas it seeks to examine are the theories, methods, and conceptual frameworks underlying the contributions of the study and implications for research and practice in HEI.

8.3.1 Reflections on Theories

This research is rooted in the Unified Theory of Acceptance of Use of Technology (UTAUT), Self-Determination Theory (SDT) and Motivation-Opportunity-Ability (MOA) framework

perspective. As discussed in Chapter Four, the UTAUT is one of the extensively used theories in the field of educational technology, and the use in this study was to enhance the progressive development of game design elements in teaching and learning in HEI in developing economies. The theory espoused four primary constructs: (performance expectancy, effort expectancy, attitude and social influence), in addition to facilitating conditions and image. However, the main contribution of this research to the theory is the inclusion of Trust. The study conceptualised trust as users' prior or current experience with an institution's ICT department in delivering innovation. The focus was on how users consider the trustworthiness of their institution's infrastructure, personnel, and management in effectively hosting gamification services. The results showed that there is a positive relationship between how students trust their institution's ICT in delivering innovation and their behavioural intention to use the innovation.

Further, all the four primary tenants of UTAUT – performance expectancy, effort expectancy, attitude, and social influence had a positive association with students' behavioural intention to use gamification in learning. Herein, referred to as ***personality traits***. On the other hand, image had a negative relation with users' intention to use gamification in HEI in Ghana. With the introduction of Trust, this study has shown that discovering new insights or identifying contextual issues and integrating them into the original UTAUT model is still relevant in addressing the criticism of the scope of technology acceptance models.

The study further tested the applicability of SDT in engaging students in a gamified information system to answer research question two. The findings suggest that SDT (autonomy, competence, and social relatedness – ***psychological safety***) is an appropriate theoretical perspective for addressing engagement and motivation in GIS (MLearn application) and learning environments. Additionally, the study examined the impact of PBL – rewards,

competition, and need satisfaction on course satisfaction in the process of student engagement (gamification outcome). The results provide support for game dynamics induced by rewards systems (PBL) and need satisfaction (autonomy), but not competence, and the direct effect of autonomy needs satisfaction and intrinsic motivation (course satisfaction). This is congruent with Kim et al. (2012) and Huang and Cappel (2005), who contend that game players fancy entertainment or fun as the primary motivation for playing games and people engage or play games to seek pleasure. Implying from the results above and the application of psychological needs of students, effective learning support strategies could be argued as those that address the issue of students' autonomy, competence, and relatedness in the gamified learning environment.

Like the SDT, the MOA framework is also a motivational theory used in this study to predict students' continuous use of gamified systems. The framework suggests that continuance use of gamification is driven by three significant factors – motivation to use, opportunity to use and ability to use. To predict the antecedents of continuance use of gamification (IS), the study conceptualised motivation as continuance use of aesthetic experience (AE), perceived information technology capability (ITC) as ability and student's opportunity to use gamification as based on perceived information quality (IQ). The framework avers that for any occurrence or non-occurrence of behaviour, the learner is affected by his or her characteristics (motivation, abilities) and the external environment (opportunities). The study results largely confirmed the hypotheses drawn from prior motivational systems research on continuance technology use. The study's method positioned AE as a higher-order leveraging classroom perception practices that encourage the continued use of GIS. AE and Perceived ITC were found to predict CU of gamification positively. The proposed effect of perceived IQ on CU, however, was not supported. Instead, perceived IQ had a positive relationship with perceived ITC about AE.

Interestingly, this study is among the first to incorporate the aesthetic experience into the CU of gamification in education. As far as is known in the literature, no previous research in IS has developed, empirically tested and validated a new AE construct as a learner-level variable. The results support the mediating effect and direct motivation of aesthetic experience in CU in education. Indicating that, a positive CU experience includes activities that result in students learning new things and having a broader perspective of what is at stake for them (i.e., self-expansion) in the gamification application.

8.3.2 Reflection on Conceptual Framework

This thesis developed three conceptual frameworks based on the identified theories discussed above to answer the proposed research questions. Thus, to understand an institution's motivation to adopt GIS, engagement, and continuance use of GIS, the study views the phenomena from three theories: the UTAUT, SDT and MOA perspective.

Since gamification in education embodies hedonic and utilitarian values, it emerged that a single theory is not adequate in analysing and explaining the infant and dimensional areas of gamification. Apart from analysing and explaining the mediating variables, there is a lack of theoretical relationship between motivation and ability when predicting post-adoption behaviours. Hence, three theoretical perspectives were selected to explain the research frameworks. These theoretical gaps were highlighted in the literature review, as shown in Chapters Two and Three.

As shown in Figure 4.2, the research framework reveals a direct relationship between the variables that consist of seven main hypotheses. The relationship indicated a positive association among five hypothesised paths, and two evidenced a negative result (image and facilitating conditions). In line with the gaps identified in Ghana's higher education institutions, trust was conceptualised to influence students' behavioural intention to adopt gamification in

learning. To this end, only five out of the seven constructs in the research framework could address students' intentions of adopting gamification and ultimately answer research question one on defining and exploring gamification. These findings do not mean the negative relationship between the two constructs, and behavioural intention does not matter in adopting an innovation. Instead, it espoused our understanding that acceptance of innovation in developing economies (i.e., Ghana) consists of facilitating conditions and image as antecedents to adoption while the other performance expectancy, effort expectancy, attitude, social influence, and trust are direct outcomes of technology adoption.

The conceptual framework for RO2, as shown in Figure 4.3, highlights students' basic psychological needs in tailoring game design elements to learning. The framework posited eight primary hypotheses explaining the direct relationship between the dependent and independent variables. The established relationship was proposed to influence need satisfaction, intrinsic motivation, and engagement within a gamified system use. In all, the study found a positive association among 6 of the hypothesised paths. In effect, the six constructs motivated how game elements induced by game dynamics support students' autonomy, competence and social relatedness in GIS. Thus, the conceptual framework supports the study's assertion that autonomous motivations are likely to be aroused by game elements among students when they feel that the system addresses their basic psychological needs.

The last research framework based on the tenants of motivation-opportunity-ability perspective shown in Figure 4.4 posited seven main hypotheses. The hypotheses explain five direct and two mediation relationships among the variables. The MOA perspective was conceptualised to mean motivation as aesthetic experience, opportunity as information quality and ability as information technology capability to use GIS in learning; these were posited to have a direct relationship with continuance use of gamification. Consistent with the identified gaps in the

literature review, ITC, IQ and continuance use were conceptualised as reflective constructs, while the four items of AE were conceptualised as formative. Four out of the five direct relationships with continuance yielded positive results. In effect, six of the constructs in the research framework could address students' continuance use of gamification in learning, hence answering research question three. In a nomological sequence of the network, the study positioned the learner's continuance use in O→A→M order, which is essential for future educational research and practice.

Interestingly, this study is among the first to incorporate the aesthetic experience into the CU of gamification in education. Arguably, no previous research in IS has developed, empirically tested and validated a new AE construct as a learner-level variable. This study, therefore, supports and extends prior work on aesthetic experience on CU with game design elements.

8.3.3 Reflection on Methodology

To answer the research questions, the study adopted a quantitative approach which is consistent with the positivist paradigm by administering a structured questionnaire. The choice of positivism in this study afforded the researcher to select a theory to generate propositions that are operationalised as hypotheses and subjected to empirical testing that is replicable. Thus, it provided the thesis with the opportunity to examine gamification from the perspective of readiness and uptake in Ghana by situating it in the technology adoption theory. It also afforded the researcher to test and validate the relationship between game elements, need satisfaction and engagement as students use the gamified interactive system. By adopting the MOA theory to examine the continuance use of GIS, the study proposed three antecedents that linked specific values of viewpoint representation (i.e. aesthetic experience, information technology capability and information quality) with specific values of viewpoint development role (i.e. motivation, opportunity and ability). The hypothesis was developed based on the propositions

from each of the theories. In all, the study developed 30 hypotheses which were tested by comparing their predictions with the observed gamified data collected. The final stage involved the deductive testing of the hypotheses, focusing on confirming or falsifying hypotheses to generalise.

First, the study 1) explored higher education institutions (students) readiness to accept gamification in learning while study 2) examined how game elements motivate the user in the learning process and 3) examined the antecedents of student's continuance use of gamification. Consequently, the findings of the study are consistent with Guba and Lincoln's (1994) argument that positivism enables researchers to discover causal relationships and make generalised knowledge of a phenomenon and predict (confirm or falsify) behavioural patterns across conditions. Orlikowski and Baroudi (1991) also align with this study by emphasising that positivist research is characterised by "*proof of formal propositions, quantitative measures of variables, hypothesis testing, and the conclusion about the phenomenon drawn from a sample to a population.*"

Second, this study adopted a quantitative research approach consistent with the positivist research paradigm. As highlighted throughout the study, the quantitative method provided the researcher with the opportunity to select abstract theoretical frameworks, make predictions about gamification outcomes using propositions (conclusions deduced logically from a theory), hypothesise the relationships, and test the research framework which espoused the nature of gamification activities in learning and their influence on other related constructs. Moreover, approaching the study from a quantitative method afforded the researcher to explore the direct and indirect relationship between the gamification outcomes and antecedents by employing a structural equation model (SEM) analytics and observing the control variables such as gender, age and level of study. The SEM also enabled the validation of the measurement model by

facilitating the reliability and validity analysis and mediation estimation. Additionally, Multiple Linear Regression was used to explain the relationship between the variable in the conceptual framework and provided support for a more robust quantitative research approach to predict behaviour change.

Further, this study's predictive analysis and causal modelling are less applicable in a qualitative research approach, hence quantitative research, and analysis. This study's sample size of 442 is quite cumbersome and difficult to approach from a qualitative method (interviews), especially in establishing the causal relationships in the three conceptual frameworks. The large sample size across three phases of this study was necessary for HEI to make the results more generalisable in developing economies, hence collecting data from similar population in UNI-GAMI in Ghana. The next section highlights the contribution of the study and its implications for research and practice.

8.4 CONTRIBUTIONS AND IMPLICATIONS OF THE RESEARCH

Theoretically, the study findings for RO1 proved that the UTAUT model is still relevant in understanding students' acceptance and readiness of integrating gamification in existing systems. However, with the introduction of a new construct (i.e., trust), new insight into the original model for user intention to use technology was uncovered. The findings showed a direct effect of trust on students' intention to use gamification – this implies that the trust imposed on the institution's IT personnel, infrastructure, and management of technology by students is vital in explaining the acceptance of innovation.

One of the contributions and implications of the second study is that it extends the self-determination theory by identifying the precursors of students' need satisfaction during teaching and learning. By framing game elements into PBL (rewards and competition), the researcher explored their effects on students' needs satisfaction. Although previous studies

have examined need satisfaction concerning why users play games by linking to intrinsic motivation, such as course satisfaction, this study moved further and introduced engagement in student learning with game design elements. This proposed research model evidenced why some GIS is more motivating and engaging than others in addressing students learning needs. Additionally, this study introduced the basic psychological need that mediates game dynamics and user engagement in response to calls for identifying mediating roles between the hedonic and utilitarian values of systems. The researcher believes that the mediating role of user engagement will add to the gamification literature by addressing students' basic psychological needs and motivation for the use of GIS.

Thirdly, the RO3 study investigated how learner experience conceptualised as AE, ITC, and IQ may motivate students' continual intention to use gamification. This study was a response to calls for more research on IT usage and user experience in education. The proposed research framework for the study broadened the gamification (technology-enhanced learning) continuance model by emphasising the causal relationship designed for user satisfaction and integrating the MOA factors.

Further, it explains how users evaluate GIS or IT through the lens of IT experience. Not only do the study findings provide support for AE (as motivation) direct effect on continuance use of gamification, but also posit a direct effect between ITC (as ability) and continuance use of GIS (IT). The significance of the relationship proves the value of AE and its intermediary role in predicting continued gamification usage. Although previous research concentrated on aesthetic experience and technology capabilities as an antecedent of gamification and technology-enhanced learning systems (pre-adoption behaviours), this study promotes literature on existing technology use by demonstrating the essential role of AE, ITC and IQ in forming post-adoption use of GIS in education. Finally, this study indicates the optional ways

to research gamification satisfaction and promote continual use. It postulates the engaging and utilitarian nature of contemporary educational systems and provides support for a multifunctional need for instructor-student engagement. By applying the findings and framework, gamification initiatives and vision for an organisation should be clear, *knowing where they want to be positioned in the future* and *how new technologies fit the school vision*. The vision should be supported with substantial resource allocation with executive involvement and a considerable improvement in IT infrastructure to support the implementation and application of GIS.

8.4.1 Development of Quantitative Inference and Meta-Inference: Contextualizing Initial Model Development

To deconstruct a meaningful and engaging integrated framework and model from this study, I developed a decision table inspired by the work of Venkatesh, Brown and Sullivan (2014) *(see Table 8.2).* It provides inferences and guidelines for identifying and integrating variations in quantitative research methods. The decisions as noted in IS are appropriate when the inference is based on reasonable certainty (i.e. quantitative data analysis) rather than the relationships happening by chance and must be based on the proposed research questions (Venkatesh *et al.*, 2014) (see page 10 for RQs recap).

By considering the 22 main hypothetical properties of quantitative research in this study (e.g. purpose and research questions, propositions and epistemological assumptions), I simply identified the existing variations in quantitative research. Subsequently, I made inferences based on the quantitative data analysis outcomes of the specific constructs (see Chapter 6). This helps in identifying all the important variables for the model development (see Figure 8.1). The principle underlying this development is the focus on *relationships* of variables rather than *listing*. As stated by Poincare (1983), "*science is facts, just as houses are made of stone .... But a pile of stones is not a house, and a collection of facts is not necessarily science*." In this

regard, my study focused on highlighting all the variables. Nevertheless, the theoretical insights for GIS in the DE context demonstrate a) how the addition of new variables in the theories significantly modifies the understanding of gamification in education and b) how I re-organized the causal relationships in the proposed conceptual frameworks (see Chapter 4).

Table 8.2 Development of Quantitative Inferences and Meta-Deduction and Inference from this study

Dependent variables and category of constructs	Specific construct	Quantitative inference	Meta-Inference	Explanation
Learners' determinants of acceptance ***Learner characteristics***	Performance Expectancy	Consistent with quantitative findings	Gamification and other e-learning related variables are mostly associated with learners' willingness, curiosity and interest in education innovations. Whether external or internal feelings of environmentally friendly learning ways, learner motivation positively affects gamification and e-learning adoption. However, when conflict arises between external and internal incentives, the learner tends to adopt gamification based on socially altruistic means	Learner characteristics and motivation continue to be strong predictors of emerging technologies (e.g. e-learning adoption) in DEs (Boateng et al., 2016). Prior studies refer to "green users" as affluent, more educated, and young people who prefer new technologies based on user characteristics and motivation (Ogiemwonyi *et al.*, 2020). Consequently, the adoption and acceptance of learning technologies in a socially mediated learning environment (e.g. UNI-GAMI) is determined more by the learner's feelings, competence or fostering a socially altruistic ambition over cost (Wunderlich *et al.*, 2019). Institutional-based trust was also a key determinant in adoption in DE. This confirms prior studies stands on the perceptual difference between HEI technology service providers and learners as consumers in accounting for adoption. *Based on the meta-deduction, the first objective of the study or antecedents of GIS acceptance may be considered as* ***learner characteristics dimension***
	Effort expectancy	Consistent with quantitative findings		
	Facilitating conditions	Facilitating conditions was not found to be significant		
	Social influence	Consistent with quantitative findings		
	Attitude	Consistent with quantitative findings		
	Trust	Consistent with quantitative findings		
	Image	Image was not found to be significant *Final decision on research method: Quantitative method is adequate to address the determinants of acceptance, learner engagement and continued use of technology in Ghana.* *Refer to Table 3.1 on the approach to Decision Choice based on gamification and quantitative method outcomes*		

Source: Author's Inferences

The quantitative method design for this thesis sought to understand the key factors that affect gamification acceptance, learner engagement and continuance use in a DE context. The overall results provide support for many of the variables. Concerning the theoretical contribution of gamification, I found that motivation is a strong predictor of emerging technologies adoption and post emerging technologies use. Internal motivation was found to be more important than external motivation. This was expected because about 70% of my variables were more individualistic and intrinsically related. An example to support this claim is the insignificant influence of image (the degree to which the use of innovation is perceived to enhance one's image or status in a social system) as a predictor of gamification adoption. Another surprising result was the insignificant effect of facilitating conditions on BI, competence on course satisfaction and information quality on continued use.

Table 8.2 Development of Quantitative Inferences and Meta-Deduction and Inference from my study (continued)

Dependent variables and category of constructs	Specific construct	Quantitative inference	Meta-Inference	Explanation
Learners' motivation-related ***Learner outcomes***	Rewards	Consistent with quantitative findings but found to be insignificant with competence	Rewards and competitive game elements such as points, badges, and leaderboards awarded learners enhanced user motivation, engagement, and performance in learning environments.	The underlying understanding in innovation literature stipulates that social motivation and competitive status gain in social learning environments are essential for early learner adopters (Venkatesh *et al.*, 2016). Conversely, social competitive status and rewards do not favour late technology adopters as diminishing social gains set in with time (Venkatesh & Brown, 2001). Diminishing returns will set in early, when learners witness unintended consequences of gamification early, e.g. cheating and usability challenges. In conclusion, engagement was a central recurring theme to understand the learner experience and motivation in using GIS in the DE context.
	Competition	Consistent with quantitative findings		
	Autonomy	Consistent with quantitative findings	The free will and willingness to use the gamified system in spare time, the social bond and discussion on the platform and the excitement improve user engagement.	
	Competence	Competence was not found to be significant		
	Social relatedness	Consistent with quantitative findings		
	Course satisfaction	Consistent with	The use of audio, explanatory videos, easy search, and the	

		quantitative findings	pause and repeat functions enhanced course satisfaction usability.	

Source: Author's Inferences

Conversely to my prediction, the results showed that tensions that arise from an introjected perceived locus of control in reality (Ryan & Deci, 2000) led learners to be more willing to adopt new technologies for learning. A meta deduction from these results is that tensions that arise due to favourable environmentally friendly learning technologies such as GIS are likely to move learners toward an environmentally friendly approach and prompt them to adopt and continue to use gamification (Wunderlich, Veit & Sarker, 2019). I summarise the meta-deductions based on specific constructs in Table 8.2. A detailed discussion of the effects of the constructs can be referred to in Chapter Seven.

Table 8.2 Development of Quantitative Inferences and Meta-Deduction and Inference from my study (continued)

Dependent variables and category of constructs	Specific construct	Quantitative inference	Meta-Inference	Explanation
Continuance-related variables * ***Learner continuance behaviour***	Aesthetic experience	Consistent with quantitative findings	Hedonic outcomes such as the aesthetic or beauty of systems and the learner's capability positively influence use behaviour for adopters in a DE context. In education, competition was found to be an insignificant factor in continued use when compared to rewards, self-expansion and meaning. This means that competition is not a salient factor in enhancing system development.	This study shows the relationship between the perception of learner characteristics of GIS and the continuance use of the innovation. Out of the four variables (rewards, competition, self-expansion and meaning) of aesthetic experience, only competition was found not significant. Thus, learners' predisposition to like innovation and novelty translates to interest in new technologies …. inherent innovativeness propels use (Wunderlich et al., 2019). A similar study found user perception compatibility and relative advantage as a positive influence on the continued use of e-learning websites (Liao & Lu, 2008). Further, information quality cannot be overlooked in the system quality and as a variable
	Information technology capability	Consistent with quantitative findings		
	Information quality	Information quality was not significant but significantly mediated the relationship between	There was no relationship between information quality and continuance use of gamification for current learners. However, it had a positive influence on information technology capability.	

		information technology capability and continuance use	Utilitarian outcomes (quality of information) were not a priority for first-time learners on the gamified platform compared to the aesthetic nature and capability.	for post-adoption behaviours, even though it had a direct negative relationship with continued use.

Source: Author's Inferences

In conclusion, the quantitative research findings from the study reveal that learners' willingness to adopt and their level of engagement with the technology influences intention to continue using GIS. As the awareness of intelligent systems for learning increases and students learn more, their decision to adopt MOOC and persuasive gamified systems become more prominent in education. The themes that emerged from the meta-deduction and inference are summarized in the next section under Figure 8 – Towards a theory development of HEI GIS.

8.4.2 Model-Driven HEI-Gamification Configuration (HEIGC) Framework

As my research on gamification in education progressed, a central focus was developed on the quantitative inferences and post-theoretical understanding of gamification. Consequently, reflecting on the study's inability to use a single theory to address the research objectives proved that a knowledge gap exists (lack of integrated framework) in tailoring gamification to the target audience based on learner acceptance, engagement and continuance use intention. To solve this, the researcher a) developed a decision table on quantitative inferences and meta-inferences to identify assumptions (see Table 8.2), b) further explored the data analysis results to identify significant relationships and trends, and c) critically reflected on the theoretical underpinnings inspired by *Venkatesh et al. (2003), Deci & Ryan (1990), MacInnis et al. (1991) and Bhattacharjee (2000)* in this study. This resulted in the development of a unified post-study theoretical framework for educational gamification: ***The Integrated Theoretical Framework of HEI-Gamification Configuration (HEIGC)*** based on three identified clusters. The identified clusters include ***i) learner characteristics ii) learner approaches and outcomes and iii) learner continuance behaviour***. The main assumption is that an interplay between

learner characteristics, motivation (engagement) and the gamified information system determines enjoyment and continuance use. To the candidate's knowledge, this is the first comprehensive study to present a framework for studying student-enhanced learning systems based on the tenants of UTAUT, SDT, MOA, and IS continuance and integrating the motivational powers of gamification (see Figure 8). Importantly, this model can be applied to target educational technologies in DEs such as e-learning systems. Table 8 shows the post-study theoretical framework while Table 8.1 shows the corresponding integrated model.

8.4.2.1 *Cluster 1: Learner Characteristics (Gamification Acceptance)*

Learner characteristics refer to attributes that are distinctive to a student, such as demographic data (age, gender, level of education) and environmental and behavioural intention components (e.g. facilitating conditions, perceive usefulness and peer influence). Precisely, the first cluster included confirmed constructs (hypotheses) on learner characteristics such as performance expectancy (PE), effort expectancy (EE), social influence (SI), attitude (AT) and trust (TR). The non-significant paths, i.e. Image → BI and social influence → BI were omitted. However, due to the strong correlation between performance expectancy and effort expectancy, this model incorporates the two as a unified construct. Previous studies have included the same from the original UTAUT model (Varannai, Sasvari, & Urbanovics, 2017). Considering the proposed model as a starting point of reference, the researcher constructed emergent paths (newly hypothesized paths) where necessary, based on prior studies on validated constructs and theoretical reasoning. The emergent paths are discussed below.

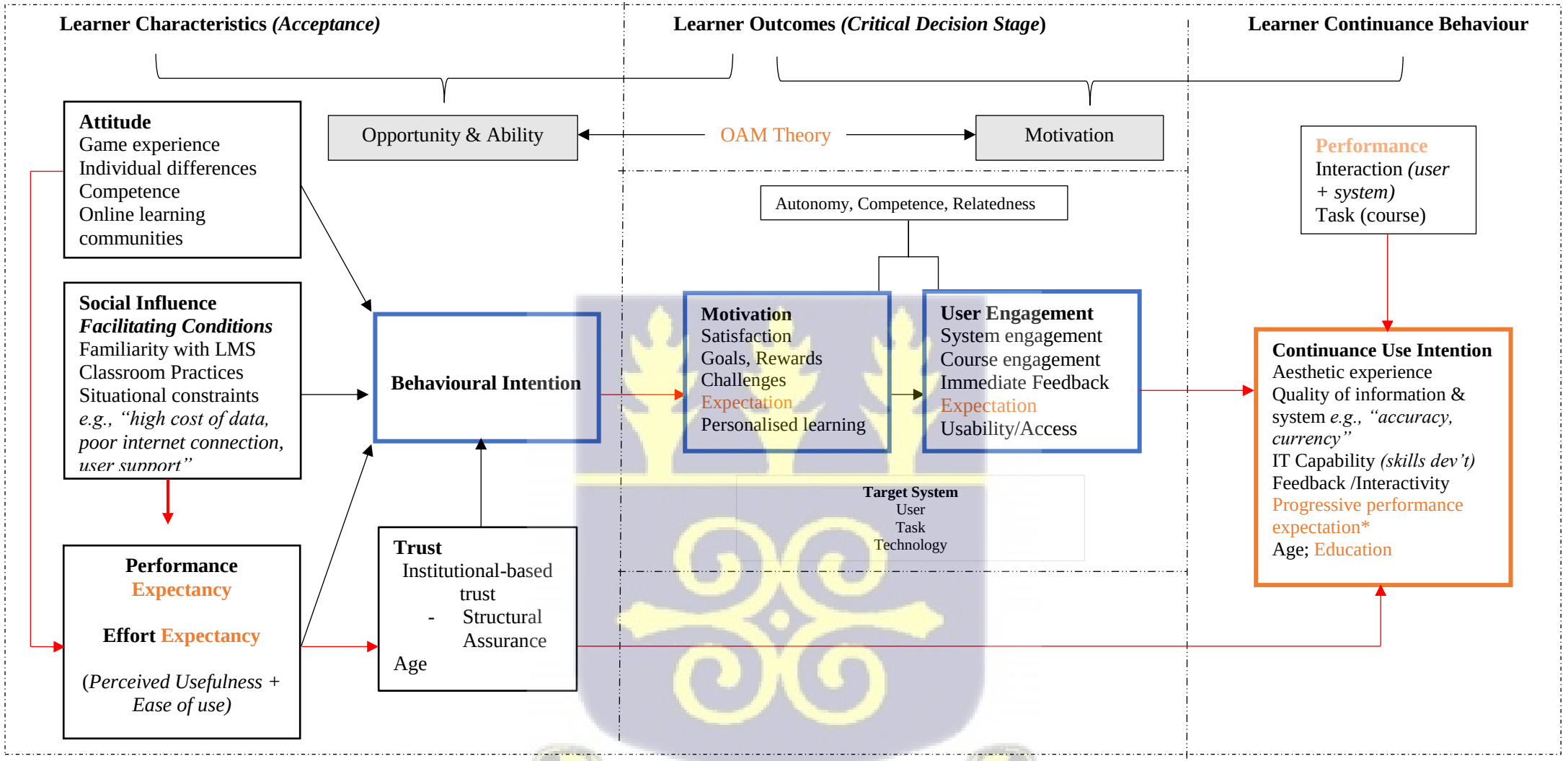
First, the relationship between AT→PE and AT→EE were included in the model. Dwivedi et al. (2019) showed that attitude towards use is partially influenced by the effects of performance expectancy and effort expectancy. Further studies on UTAUT also indicate that performance expectancy had a significant direct impact on attitude. However, Šumak, Polancic and Hericko

(2010) emphasized the need for further studies that directly address EE and PE's influence on attitude behaviours towards IS use. Consequently, the path from attitude to PE and EE indicates that users with a positive attitude are more likely to perceive ease of use and usefulness. Furthermore, the relationship between FC→PE and FC→EE were incorporated into the model. FC are motivational factors that represent the resources and factors that the students believe exist to support their learning. The presence of these conditions promotes perceived usefulness and ease of use (i.e. high FC would increase PE and EE when using the GIS). Thus, FC is positively related to PE and EE of gamification learning.

Second, the path EE→TR was considered in the model. Though it is an unexpected path in the model, the path has been explored and empirically supported in previous studies. For example, Chang *et al.* (2017) showed that effort expectancy leads to higher levels of trust in systems. Further studies on technology adoption have also revealed a positive relationship between ease of use and TR (Chang *et al.*, 2017). In the absence of better information, the relationship logic is that users are more likely to use available information such as ease of use to judge trustworthiness. Also, the study established the significant relationship between social influence (SI) and behavioural intention, hence the inclusion.

Trust as an enabler to technology use was introduced in this study and revealed a positive relationship with behavioural intention. The study was particularly interested in this construct because of the limited research in this area, especially in HEI in developing economies. The structural assurance dimension of trust (i.e. a component of institutional-based trust) that was applied espoused the important belief that "structures are in place to promote success" or enhance teaching and learning with new technology.

Figure 8 Post-Study Theoretical Framework for Tailoring Gamification in HEI



A Proposed Integrated Theoretical Framework of HEI-Gamification Configuration (HEIGC)

Legend
- New addition/discovery* to theory
- → Significant path
- → Emergent path
- → Main constructs

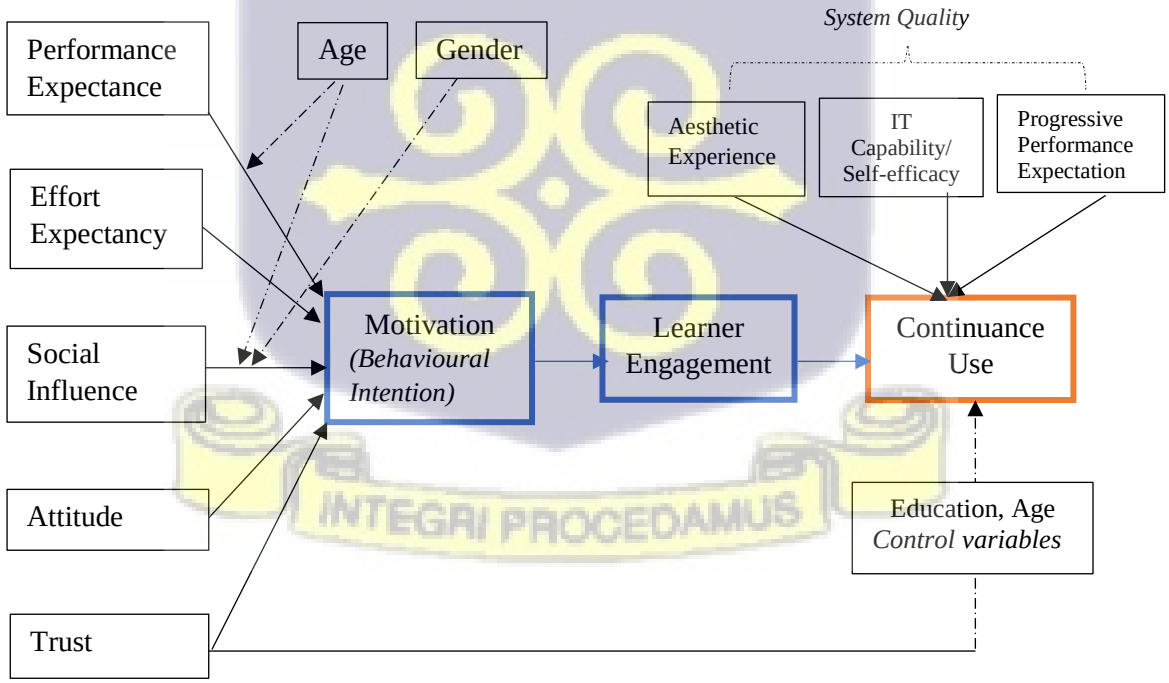
TR played an important role in the pre-usage or adoption stage in this study. The proposed model expects TR to play similar in the post-adoption stage (continuance use) associated with the gamified system.

Further, with the notion that trust develops gradually and changes over time as users interact with the system, the model proposes the effect of TR over time. Thus, few studies have examined the effect of TR overtime on behavioural outcomes such as engagement and continuance use (Bhattacherjee, 2010). Hence, the post-study theoretical framework proposes that TR examined over time will positively affect the continuance use of the gamified system.

8.4.2.1.1 Measures – Post-Study Integrated Conceptual Model

The constructs presented in Figure 8.1 is deconstructed from the HEIGC framework to represent the post-conceptual model for adoption, motivation and learner engagement and continuance use of GIS in a developing economy context.

Figure 8.1 Post-Study Integrated Conceptual Model



The proposed model seeks to impose order on how the gamification variables are potentially interrelated in formulating research questions (O'Brien & Toms, 2008) aligned with the HEIGC model. The first dimension (adoption factors) identifies the contextual determinants and conditions for successful gamification implementation in DE. The determinants of GIS include PE, EE, FC, AT and TR being moderated by age, based on the UTAUT constructs. The second dimension (motivational factors) identifies the learner characteristics and motivational powers of gamification (PBL – rewards and competition) to motivate and engage the user to the desired outcome. The degree of influence learners can exert on the GIS depend on the level of competence and social relatedness assigned to the students and the perceived competence. The final dimension identifies the determinants of continuance use of GIS. The model indicates that an increased aesthetic experience, perceived IT capability, and progressive performance expectation (i.e. system quality) engages learners and promotes continuance use of educational GIS. These three variables constitute system quality in this study. In this regard, system quality is the perceived expected performance shown in a gamified platform's overall performance.

Further, based on the HEIGC framework and model, extant literature analysis on gamification and after carefully examining the data results, this study develops the following research propositions. The research propositions link the various analysed constructs: technology adoption, motivation, engagement, and continuance use.

***Proposition 1**: Learning management systems can facilitate students' learning by adopting and integrating gamification elements that support all stages of the gamified learner journey.*

***Proposition 2**: Student's contextual needs at the adoption phase can improve their motivation to adopt future new technologies, enhancing informativeness and interest.*

***Proposition 3:** Institutional-based trust in students' prior experience can influence the adoption of new technologies based on existing facilitating conditions for learning.*

***Proposition 4**: Highly engaged students are more likely to continue using the GIS than less engaged students.*

Proposition 5*: Social relatedness (social media) and autonomy can improve learning and systems engagement during the post-continuance use phase, enhancing edutainment and social dimension.*

Proposition 6*: Age and gender moderate the relationship between performance, social influence and motivation of GIS.*

Proposition 7*: Designing and integrating aesthetic experience can support gamification learning, enhancing students' continuance use of learning systems.*

Proposition 8*: System quality of GIS affects continuance use intention.*

8.4.2.2 Cluster 2: Learner Outcomes (Motivation and Engagement)

A learning outcome is an indication of what a learner should know and accomplish at the end of a course, as well as how effective they should be engaged and motivated to achieve the results. It specifies the level of motivation as well as how the content is demonstrated on the platform. In this research, much attention was paid to learner outcomes in terms of motivation and engagement through the gamified information system.

Engagement is an important dimension of students' education as behaviourally engaged students achieve higher performance and participation than disengaged students. As shown in the RO2 results, there is a strong positive relationship between motivation and user engagement behaviours in a gamified system. Since the relationship between motivation (satisfaction) and engagement was significant and central to RO2, they were included in the HEIGC model. The successful congruence of this relationship is what I refer to as the ***critical decision stage***. At this stage, the level of engagement and motivation students experience on the platform would boost their interest, ultimately determining their post-adoption behaviours (continuance use).

The researcher reviewed literature and found considerable studies in various academic fields to establish the relationship (emergent path) between user engagement (motivation) and continuance use. For instance, Ozturk *et al*. (2017) found that once an individual is positively or negatively engaged or motivated by technology, the actual use is affected by the level of motivation. However, few studies have investigated the effect of motivation and engagement

with GIS on continuance use. In this regard, it is logical to propose that engagement and motivation towards a gamified system is positively related to continuance usage.

8.4.2.3 Cluster 3: Learner Continuance Behaviour

The learner continuance behaviour describes the success or failure of learning activities that are primarily determined by the learning platform and the prevailing learning environment. The researcher at the final stage of the model (i.e. continuance) found an exciting trend. Thus, students' expectations were found in cluster 1 and cluster 2. However, at the continuance use stage (cluster 3), there was no specific expectancy construct. Therefore, to sustain and actualize students' expectations in the model, the researcher introduced the *progressive performance expectations (PPE)* based on the literature review (see Devaraj & Kohli, 2003). This expectation seeks to address the adoption, motivation and use of gamification (IS) over a while. The PPE entails the changes that the gamified system undergoes to meet educational goals as well as the students' and instructors' needs and wants in teaching and learning. The changes herein refer to the user characteristics, the task or activity characteristics and technology. Based on these considerations, performance expectation within a gamified system can be measured per user engagement and alignment with the system. Accordingly, it is logical to posit that *user engagement with the system will positively impact progressive performance expectation.*

The model also lists specific performance effects such as interactivity (user and system) and task (course) performance as an antecedent of continuance use behaviour. Therefore, HEIs can measure the outcome of the model based on the performance indices. Further, future studies can examine the consequences of the task or learning outcome, the system features and functionality, and the user experience or interaction with the gamified system. Additionally, to advance research in this direction, the researcher recommends adapting established instruments from Compeau *et al*. (1999) and Kunter and Baumert (2006) on goal attainment and task characteristics to operationalize this model. Finally, as the findings from the third research

objective repositioned the MOA in an OAM direction, the researcher found that the measurement items in the constructs under the technology adoption (i.e. antecedents) aligned with the *Opportunity and Ability framework.* Similarly, *motivation* aligned with user engagement and continuance use measurement items (i.e. behaviours, conditions and consequences). Thus, the OAM framework (antecedents, behaviours and consequences) fits the three categories of the unified theoretical framework of HEI-Gamification Configuration (HEIGC). The findings suggest that since GIS is new in DEs and for a behaviour change to occur, there is a need for an **Opportunity** to experience it or try it *(triability).* Then for triability to lead to acceptance or intention to use, there should be **Ability** to perform the behaviour and the ability includes learner characteristics and the ease of cognitive understanding of the GIS and social influence of others who are prepared or willing to use it. In this regard, ability is the trust/competence to use the LMS and GIS; and the social influence of other students who are ready and willing). **Motivation**, therefore, becomes an outcome because an opportunity has been created.

The **model implication** of **OAM** for HEIs is that: Due to the nature of the gamified learning activities, it requires an *intentional effort* from the institutional ICT centre (developers), faculty or instructor to integrate it into the work. Thus, the **ability** and **opportunity** to do so matter. For the instructor to **continue** engaging in GIS activities, the **results** must be evident—hence, the need to feel **motivated or reminded** to perform the behaviour.

Key determinants of behavioural change from this thesis: Fishbein *et al.* (2001) identified determinants like intention, self-efficacy, attitude, intention etc as the behaviour changes in their research. This study identified some key determinants of behavioural change from the use of GIS in higher education. Table 8.2.1 compares Fishbein *et al.'s* (2001) determinants to those I identified in this thesis.

Table 8.2.1 Determinants of behavioural change from the HEIGC model

Fishbein et al.'s (2001) determinants	*Author's determinants*
Norms	*Social influence/ game dynamics/mechanics/feedback*
Self-efficacy	*Challenges/opportunity/ ability/ competition*
Attitude	*Anticipated (gamification) outcomes (engagement/ relatedness/ autonomy)*
Environmental constraints	*Situational / environmental constraints*
Self-standard	*Progress /course knowledge/social (group) identity*
Skills	*Competence/ capabilities*
Intention	*Motivation/goals/rewards/expectations/critical decision*

8.5 IMPLICATIONS FOR MANAGEMENT AND PRACTICE

The study found motivational support for gamification in learning in higher education. Specifically, the study found that attitude played an important role in students' intention to use gamification. Thus, attitude had a direct effect on behavioural intention – which implies that higher education institutions may need (find it useful) to shape students' attitudes for influencing behaviours. Context-wise, the researcher found trust and social influence to directly affect behavioural intention to use gamification. This implies that students will associate a prior experience with institutions' services (IT) or preparedness in championing the use of new technology. Therefore, educational institutions should provide training and high-quality infrastructures to boost learning and, in effect, predispose students to new technologies such as game design elements in education. Accordingly, designers should incentivise social elements to include social learning and comparison or competition to improve the potency and use of game design elements.

Moreover, the significant effect of performance expectancy and effort expectancy on user intention shows the learner's importance to gamification adoption. Hence, higher education should prioritise the usefulness of the gamified system and its corresponding ease of use for active user engagement.

The researcher believes that this study (RO2) will be particularly useful for educators, especially when designing gamified learning materials. The findings indicate that the competition or challenges among students on the gamified platform are influenced by competence and social relatedness. This presupposes that students are likely to improve their skills or competence to compete in the environment in which they find themselves. For instance, if the leaderboard displays players other than themselves, they are compelled to improve their performance to earn class recognition. Likewise, through competitive engagement, students develop social interactions with their peers. For example, a conversation on a gamified platform may turn into a normal conversation. Moreover, points, leaderboards, and badges allow students to recognise each other's accomplishments, promoting friendly learning competition and enhancing the general learning performance. In general, designers of educational games should design appropriate competitive game dynamics that foster students' learning engagement in the assignment at hand, since most of the time students will access these materials off-campus and in private learning modes. Systematically, this study shows how game dynamics can be conceptualised in practical life to encourage societal needs in rewarding the best performing users and how game design elements can be utilised in the classroom settings to comprehend the traditional classroom activities.

As an opportunity for promoting innovation in education, this study on gamified learning contributes to pedagogical strategies in teaching and learning. *Pedagogically*, the gamified system promotes learning and teaching based on personalisation (i.e. leveraging student-specific data) to make the customised system more receptive. This helps redefine the learners' roles as not only taking responsibility for their learning needs but also providing support to colleagues and engaging in discussion to create content and milestones. Simultaneously, teachers become mediators, coordinators or referees rather than lecturers or instructors on the gamified social media platform. *Technologically*, GIS increase the availability and accessibility

of learning materials and provide different game design elements for personalised learning and nurtures capabilities in developing flexible skills. Institutional-wise, gamified social media contribute to *HEIs innovation* by making education more open and dynamic in responding to time (especially in this COVID-19 era). HEIs have to evaluate their LMS or online learning communities for a possible integration of game design elements rather than developing full-fledged gamification to enable a flexible learning continuum.

Based on the RO3, this study offers practitioners user satisfaction insight and an understanding of how to improve learner engagement and the use of contemporary educational technologies. Notwithstanding the MLearn (game learning mobile application) as the only target system for this study, the research framework highlights the broad characteristics of modern multifunctional gamified applications for teaching and learning. To this end, the results of this research can improve the understanding of the user's general continued use of contemporary education technologies for teaching and learning, which includes the hedonic and utilitarian aspects of system engagement. Also, for an engaging and continued use of learning systems, developers must consider the education environment (physical classroom and context) in which the mobile gamified application will be employed (Sung, Chang & Liu, 2016). In line with this, Mostakhdemin-Hosseini (2009) suggests that gamified technology must be compatible with how learners use educational resources and easy to use in the classroom.

Further, starting with *technological game elements pluralism* would display a variety of game-based mobile applications for educational institutions, which in turn provides platforms and game elements that suit their students and help avoid some resistance to adopting technologies for teaching and learning. Ultimately, the deployment of gamification elements should be compatible and standardised with the institutions existing IT infrastructure to enable a smooth operation of the learning technologies. For instance, since most higher education institutions

in Ghana use LMSs with no game design elements, the integration of the game elements should be consistent with the student's use of LMS as it adds enjoyment and fun to the current setup. Additionally, the focus on users' aesthetic experience (AE) with a gamified system in this study permits us to take a closer look at the design features of contemporary educational technologies. The study suggests the importance of GIS designed to appeal or invoke CU or the aesthetic experience of students. Thus, the more immersed or engaged students are with the gamified system, the more they perceive the system's hedonic performance and utilitarian value, which in turn leads to satisfaction and intentions to continue using gamification in education.

Finally, HEI need not implement gamification because other institutions are harnessing the benefits without proper user assessment. Other situational factors need to be assessed, i.e. the system should be situated in the context or more substantial activity of the materials gamified. Through interactions with the gamified system, an HEI may identify common patterns or user characteristics that can inform system redesign. Thus, in the *context of games*, the players' motivation to continue playing is essential, while in the *educational context*, students acquiring knowledge is central to the gamified system. Subsequently, to benefit from the motivational powers of games in education, learning goals or activities must align with the goals of games. Thus, GIS should support students learning activities (goal achievement) and engage and motivate them through enjoyment (Deterding *et al.*, 2015).

8.5.1 Tailoring Gamification in HEIs in Ghana – Practitioners' Guide

After successfully developing the HEIGC framework, I presented the model to practitioners to solicit their views and determine its efficacy. The follow-up was to gain deeper insight into the mechanisms that would enhance learning and identify in-game behaviours of players. In a short zoom presentation to practitioners in higher education institutions (mainly instructors and lecturers from the University of Ghana, Baldwin University College, and GIMPA who are

using gamification) in Ghana, six (6) gamification guidelines were developed to deconstruct the process of gamifying learning or applying gamification to target systems (see Figure 8.2). To better appreciate the model, readers would have to visit the HEIGC framework (see page 170). This framework guideline aims to extend to other domains such as motivation information systems and persuasive systems where interventions to increase engagement and continuous use are anticipated. The following are the guideline steps:

1. Understanding the Context or Facilitating Conditions

What is the context or facilitating conditions that surround the learning program? According to the Queensland Studies Authority (2004), the context of education refers to a group of learning experiences that encourages students to transfer their understanding of key concepts to situations that mirror real life. In this regard, the focus is on the environment where teaching or instruction takes place. A context analysis can provide information on the teaching and learning process, the setting, student class size, and the subject or curriculum.

2. Understanding the Target Audience

Who is the intended or target audience? A clear understanding of who the students are promotes the success of GIS and, consequently, the education program. As shown in RO1 results (see page 121), the target audience factors include age, level of study, competence or skillset, preferred game type and, playing and learning habits. A clear understanding of context and target audience can promote a better understanding of gamification use and facilitate motivation and effective student engagement.

> *"Importantly the duration of the lecture, the physical and emotional factors, the motivation level and skills of the students and the nature of the course are crucial factors when analysing the context and target audience, i.e., the students for any developmental or learning program" – (Interview with Lecturer, 15 September 2021).*

The interview with the lecturers revealed that universities create a professional learning culture that promotes innovations when they commit to helping teachers and students with new technologies. To best understand the target audience, teachers and universities must constantly look internally and externally to improve their practices and understand new technology opportunities to define entirely new teaching and learning experience for students.

3. Defining the Learning Goals into Milestones

At the end of the learning activity, what objective does the instructor want the students to accomplish or achieve! The learning goals should be identified and structured into goals to meet each milestone in the proposed gamification system. This would lead to the achievement of the learning goals as well as gamification tasks based on the syllabus and assigned milestones. This is the crucial stage to decide whether to *"gamify or not to gamify" (see Figure 8.3 for guiding questions to inform such decisions).*

4. Resource Identification and Allocation

The next section is to identify the institution or department resources and time allocation with stakeholders such as curriculum developers and gamification developers. The outcome of this exercise is to determine the resource needs and provide guidance for transition from the existing programmes developed to gamification platforms.

5. Identifying Students' Gamification and Applying the Gamification Elements

Which of the game elements motivates your target audience? Understanding the students playing habits and preferred gamification elements is essential to activate positive student behaviours in the right context. Consequently, students' gamification needs should be considered before applying the right rewards or game design elements. The type of game design element should have meaning to the users, not a one-size-fits-all element. Two questions guide the decision of gamification development 1) should we build a gamified system and 2) what

gamification tools to use (see Figure 8.3). By building the gamified system, the HEI should consider the business problem with teaching and learning to be solved and the task technology fit (the degree to which the gamification or technology will support the teaching and learning task) – because a poorly developed gamification system can result in negative and unintended consequences toward teaching and learning. Furthermore, the expertise of developers should be considered. In the case of UNI-GAMI, the researcher found the lack of developers to be the contributing factor to the low uptake of GIS. In conclusion, the uptake of gamified systems in developing economies is slow because the educational game players and stakeholders remain in consumer mode instead of developers and designers of GIS.

In the case of UNI-GAMI, only two departments were found to champion the use of gamification. Interestingly, it was based on the instructors' or lecturers' (individual) commitment and not a department requirement or university policy to improve motivation and engagement with GIS. To support the *"individual"* commitment claim, the nursing and midwifery departments were found to promote gamification in HEIs more than the technology-enhanced or computer science departments.

On the other hand, the gamified tools available include the point system (tracking and feedback), badge system (goals and rewards) and leaderboards (competition and challenge).

Figure 8.3 Questions Guiding Decisions about Gamification

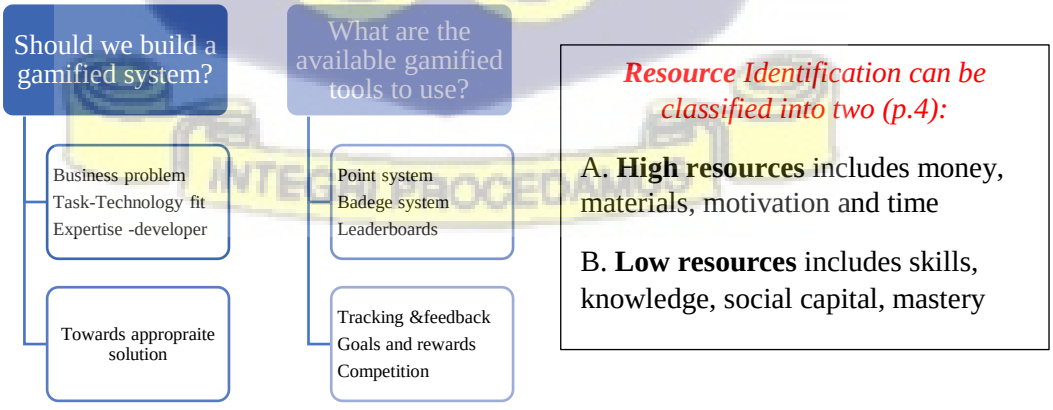
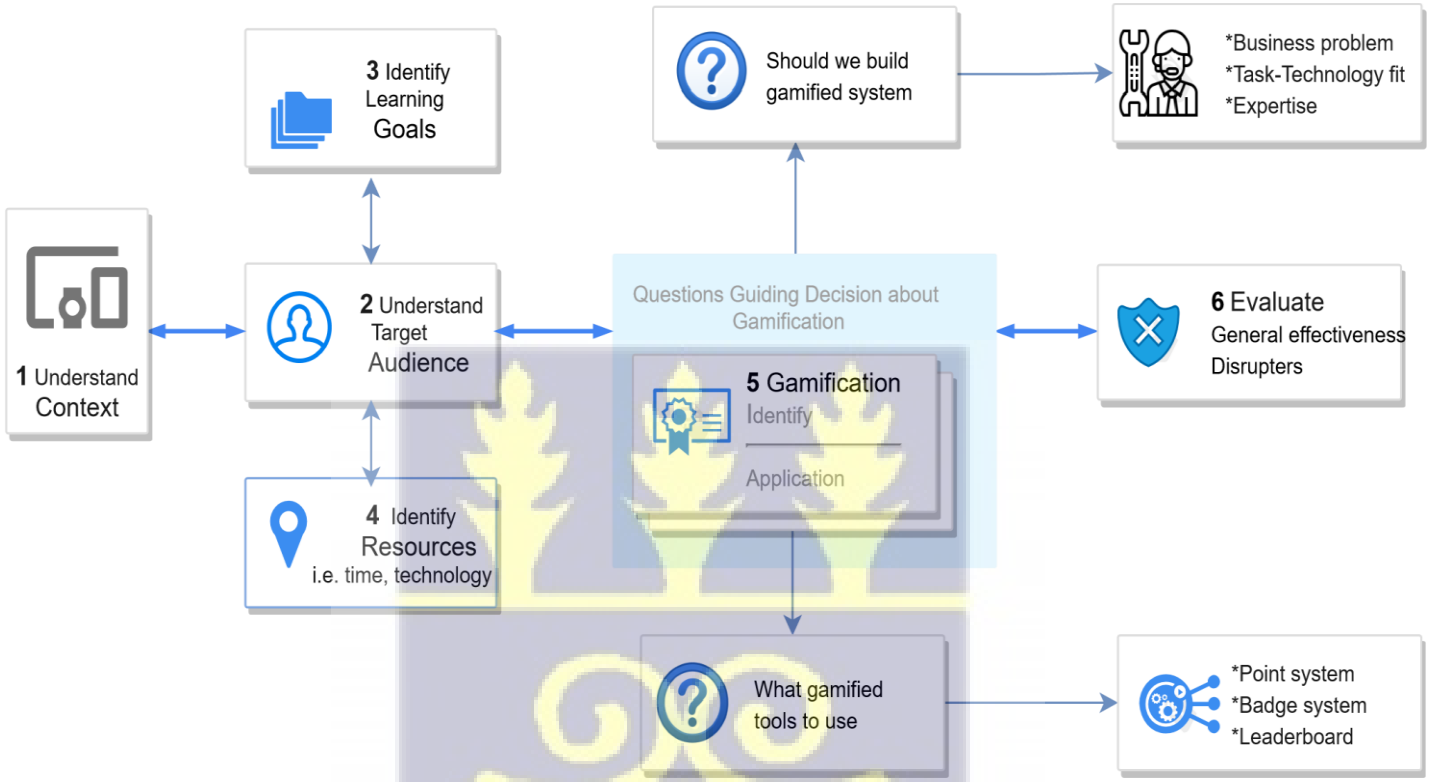


Figure 8.2 Tailoring Gamification in HEIs - Practitioners' Guide



Source: Authors' Guideline

Five Key Questions When Considering Gamification Strategy in Education as an Emerging IS Practice

1. Is gamification the right learning solution?
2. How are gamification standards being established in HE?
3. How can gamification strategy comply with HE tech legislation given teaching and learning uncertainty?
4. How is gamification sustained and governed in HE?
5. How can a viable and undisrupted gamified learning ecosystem be established?

The instructors' experience with Kahoot shows that they enjoyed the prompt feedback and the social connectedness relating to gamification. The participants highlighted the gamification strategy necessary for a tailored learning approach. Below are some of their comments:

- *"I am particularly happy with the timely feedback with real-time notifications. It helps to monitor progress towards goals. Among the game design elements, the badges and leaderboards are the best features. Accumulating appreciable points will earn you the hero or mastery of the course" – (Interview with Lecturer, 15 September 2021).*
- *"Social bound and support – the team-based challenges, when leveraged appropriately, improves social learning. Students can quickly form teams to work on assignments" – (Interview with Lecturer, 15 September 2021).*
- *"Curiosity and anticipation about learning activity heighten one interest."*

6. Evaluating Student and System Performance for Continuous Improvement and Retention

Lastly, the starting point of assessing the guideline for applying gamification is to evaluate the general effectiveness and results. The results can be re-integrated into the context phase since user characteristics change per academic year. The evaluation can be from the student's perspective of engagement or the system's functional requirements. Instructors are to take note of disrupters and unintended or negative consequences associated with the system; else, the objective of gamified learning will not be achieved. As a principle of good usability practice, the experience of the gamified user should be evaluated (i.e. for currency and accuracy) and updated regularly. This practice will ensure that the teaching and learning goal of both the instructor and student is achieved.

In summary, the interaction with the practitioners highlights three (3) main phases out of the six (6) practitioner guide shown in Figure 8.2. The simple 3-phase steps can guide designers and practitioners in GIS to personalise the experience of learners. The phases include adopting new technology, integrating technology, and leveraging opportunities to innovate:

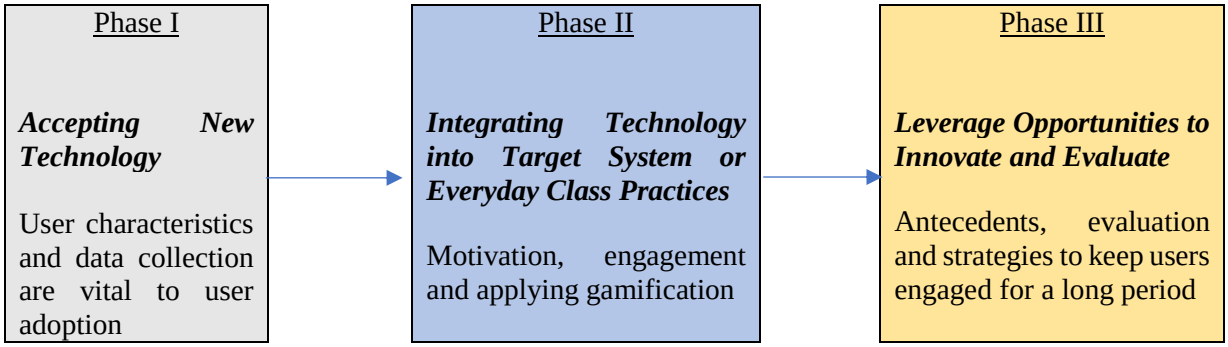


Figure 8.3.1 Phases of Gamification Learning Systems Innovation in this Study

8.5.2 Covid-19 Pandemic: SWOT Analysis of Gamified Online Teaching and Learning in Higher Education in Ghana

This study would be incomplete without contributing to the discussion on the ongoing coronavirus 2019 (Covid-19) impact on education, especially with the timely relevance of my research. This is because the result of my study has implications on the impact of Covid-19 on online education – where the pandemic has enforced a shutdown of educational institutions at all levels in Ghana with online education as the only alternative. As stated by UNESCO and UNICEF (2020), learners in these times are looking for motivation to study and improve their performances with various learning systems in the offing, while teachers are hasty to explore online teaching strategies. In the context of UNI-GAMI, students' approach to learning changed drastically, as the authorities suspended all traditional teaching methods for virtual instruction.[3] It should be noted that the data for this thesis were collected before the start of Covid-19 in Ghana, i.e. March 2020 . Consequently, I provide a scoping SWOT analysis of GIS as online teaching and learning solution based on the themes that emerged from the meta-

[3] *Following the directive by the President of Ghana, all universities across the country suspended face-to-face teaching and adopted virtual platforms for lectures. Popular universities in Ghana such as University of Ghana, Kwame Nkrumah University of Science and Technology and Ghana Institute of Management and Public Administration sent notices in print (graphics) and social media outlets for the adoption of online learning platforms for the remainder of the semester. Interestingly, some universities had to defer students who could not adopt online education from home for that semester. However, modalities on deploying online classes for students were shared with the university community. Refer to the Teaching and Learning Continuation memo sent by Ashesi University on 16/03/2020 as an example of the impact of Covid-19 on online learning in Ghana via https://www.ashesi.edu.gh/resources/covid-19-safety/community-updates.html#Update_4*

inference in Table 8.2 and Figure 8 and my interview with the lecturers/instructors (see Appendix B3 pg. 271). In this regard, I summarize the strength, weaknesses, opportunities, and threats that gamification of e-learning systems presents for post Covid-19 developing economies especially, Ghana. However, some of the general educational impacts of Covid-19 on HEI learners in Ghana are surveyed and included in the SWOT analysis. I begin the section with a brief background of the Covid-19 pandemic in Ghana.

8.5.2.1 Insight from Ghana on Covid-19 Pandemic

By December 2020, three hundred and twenty-three (323) people had died of Covid-19 and more than 54,000 Ghanaians had tested positive. As of 11th October 2021, Ghana has recorded 128,368 confirmed cases with 1,158 deaths, of which males represent 57% and females 43% (Ministry of Health, 2021). The impact of Covid-19 affected all aspects of Ghanaian lives, including social, economic, political, health, education, and general well-being. Consequently, the government of Ghana put in measures to prevent and mitigate the effect of the pandemic. Some of the measures included:

- *Closure of schools, restaurants and bars, places of worship, and importantly limiting the number of people in a gathering.*
- *Mandatory use of face masks in public spheres*
- *A temporary three-week lockdown of Greater Accra and Ashanti Region (specifically Kumasi) from 30th March to 20th April 2020.*
- *Travel restrictions and closure of the border.*

Though the impact cut across all spheres of life, the researcher's interest lies in the closure of schools and the impact of the Covid-19 pandemic on online education in Ghana, especially HEIs.

8.5.2.2 SWOT Analysis of Gamification of Online Learning during Covid-19 Pandemic

In the aftermath of Covid-19 pandemic, knowledge delivery has become a challenge in Ghana HEIs. While some universities are delivering teaching via a hybrid approach, others are resorting to virtual or face-to-face. Interestingly, there is no consensus for post Covid-19 teaching and learning methods among HEIs after school disruption in Ghana. Moreover, many instructors and students faced psychological issues during the pandemic – e.g. fear, stress, depression, insomnia, and anxiety, leading to a lack of concentration and focus (Di Pietro, 2017).

In recent times, e-learning has gained popularity in developing economies especially, Ghana. Massive Open Online Courses, among others, are hosted on various platforms at an affordable rate. With a plethora of LMS, many HEIs in Ghana were reluctant toward e-learning or online teaching. However, the Covid-19 pandemic and its associated challenges (re)-introduced online learning and virtual work to all stakeholders in HEIs. The rapid adoption of remote teaching platforms employed by instructors in UNI-GAMI includes Sakai, blackboard LMS, Microsoft Meet, Kahoot, and Google Hangouts. Among these platforms, ZOOM was the most patronized, preferred and used. The innovation with these platforms was the addition of gamification elements such as points, badges, leaderboards, hands-up for questioning, discussion rooms, team formation, intelligent tutoring videos and audios, avatars and storyline.

Consequently, some of the learning systems were nicknamed ‘Gamified E-learning’ to show the integration of the game design elements (Saleem, Noori & Ozdamli, 2021). The integration of gamification into existing LMS or target systems motivates learners and enhances student engagement during pandemics. Table 8.3 shows a summary of the SWOT analysis of gamified e-learning during the Covid-19.

Table 8.3 SWOT Analysis of Gamified Online Learning during Covid-19 Pandemic

Strength	Weakness
• Immediate feedback with gamification elements with increased engagement • Excitement, fun and enjoyment with game design learning and teamwork • Customization of avatars and design elements to influence learning • Location and time flexibility in teaching and learning • Revisiting recorded videos to gain further insight. Lead to personalisation of learning • Improve learning outcomes with gamification. The feeling of having learned • Social learning, access and usability • Increase student confidence and high learning engagement with small group size	• Inappropriate learning conditions at home may lead to low participation • Poor access to ICT resources • High cost of internet access • Technical difficulties on the part of the instructor and the learner • Distraction, anxiety, stress, and frustration in gamified e-learning • Discipline and time management in engaging in online learning • Lack of physical attention and peer influence in learning • Learner confidence level and capability • Large class size may lead to limited or no engagement
Opportunities	**Threats**
• Improving the digital competence of students via virtual means • Exploring engagement and motivation means through the potential of games • Developing instructors and lecturers' technology capabilities and providing infrastructure to augment new teaching dimensions • Opportunity to integrate responsive strategies and emergency preparedness in gamified e-learning systems at HEI level to respond to future pandemics • Real-world engagement	• Disruption of learning and school schedules • Unintended consequences of long and short-term learning outcomes with GIS • Time constraints and difficulty in gamifying education resources and curricula • Lack of developers to assist instructors in developing GIS • Financial and motivation resource constraints in gamification • Short lasting though with high engagement • Remote work or learning is not mandatory

The ***strength*** of gamified online learning stems from the immediate feedback it provides learners and the excitement and fun associated with high learning engagement. As was witnessed with the Covid-19 pandemic, the lecturers revealed that they engaged the learners from different locations and times. Further, gamification improves social learning and increases students' confidence and high learning motivation, especially with a small group or class size.

There are ***weaknesses*** with gamified online learning that can dispel the interest of both teachers and students. The most common factors are the technical challenges that can hinder communication between the teacher, learner, and the gamified system. Also, a large class size may lead to limited or no engagement. Similarly, inappropriate learning conditions at home may lead to low participation, notwithstanding the high cost of internet bandwidth and

distraction, anxiety, stress, and frustration in gamified online learning in DEs. Figure 8.3.2 illustrates emerging fields for gamified e-learning technologies in higher education as propagated by the Covid-19 pandemic.

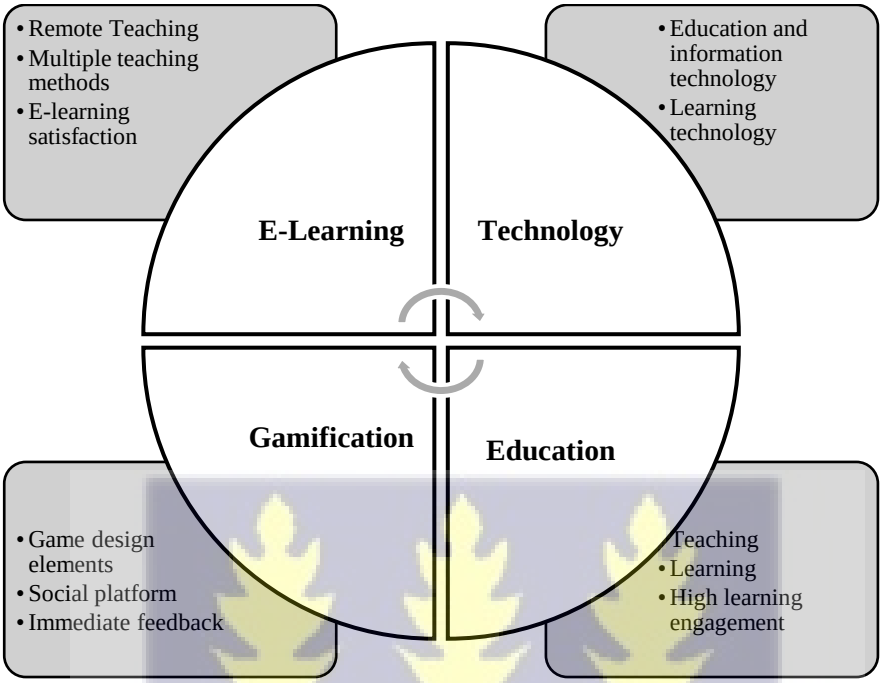


Figure 8.3.2 Emerging Fields in gamified e-learning in Covid-19 era

However, these weaknesses give rise to ***opportunities*** for learners in online learning. First, it improves the learners' digital competence for future payoffs. The Covid-19 pandemic has also allowed HEIs and educational institutions to explore engagement and motivation to learn through the potential of games. Further is the opportunity to integrate responsive strategies and emergency preparedness in gamified e-learning systems at the HEI level to respond to future pandemics. The ***threat*** to gamified online learning is the unintended consequences of long and short-term learning outcomes with GIS. Other threats include time constraints and difficulty in gamifying education resources and curricula in DEs.

The lack of developers to assist instructors in developing GIS, and the financial and motivation resource constraints are a threat to the development and growth of online education in times of

pandemics in the DEs context. In assessing the SWOT and impact of the Covid-19 pandemic on DE education and technologies, the researcher found it interesting to explore the learners' interest in future learning technologies. The next section focused on such implications.

8.5.3 Implications for Learners' Interest in Future Learning Technologies in Developing Economies

From my study, I was curious to understand why information quality did not positively influence the continuous use of learning technologies, especially when measured with aesthetic experience and information technology capabilities (refer to page 150). In this regard, I conducted further studies based on the four dimensions of information quality (i.e. format, currency, accuracy and completeness) with four other contextual factors (i.e. websites, user, social, and task characteristics). The result of this study is published in IEEE Conference on Business Informatics (see Appendix C no. 6, page 238). Interestingly, the estimates of the contextual factors were higher and largely supported the learner's immediate interest and benefit than the information quality dimensions. Implying that students placed more emphasis on contextual factors than the dimensions of information quality *(research gap for future studies).*

The implication of these two results means that learners in future would focus more on aesthetics fascinations and emotions, self-efficacy and capability and contextual or cultural factors to use future technologies. What learners are less likely to focus on is the difficulty and time to memorize information (quality) because memories will be easily uploaded and downloaded. This will give birth to a more *sophisticated gamification intelligent tutoring system in developing economies.* With the fast advancement of artificial intelligence and big data analytics, I see the revolution is here with us. Therefore, there is a future for gamified learning systems and designers that focus on increasing personal relevance or using game

design elements to match learner characteristics. Since GIS are emergent in DEs, this study has shown some of the learner differences and consequently calls on future research to determine the types of learner differences that can improve gamification outcomes in HEIs in DE.

Figure 8.4 and Table 8.4 represent the dimensions and facets of gamification frontiers for learners' future interest in technologies with game design elements (persuasion) at the hub of innovations. The figure depicts the current state or frontier of gamification and how it might move in the future based on two dimensions – *learning engagement and performance*, *and continuance use* and managing innovation in an education context.

Figure 8.4 The Frontiers of Gamification

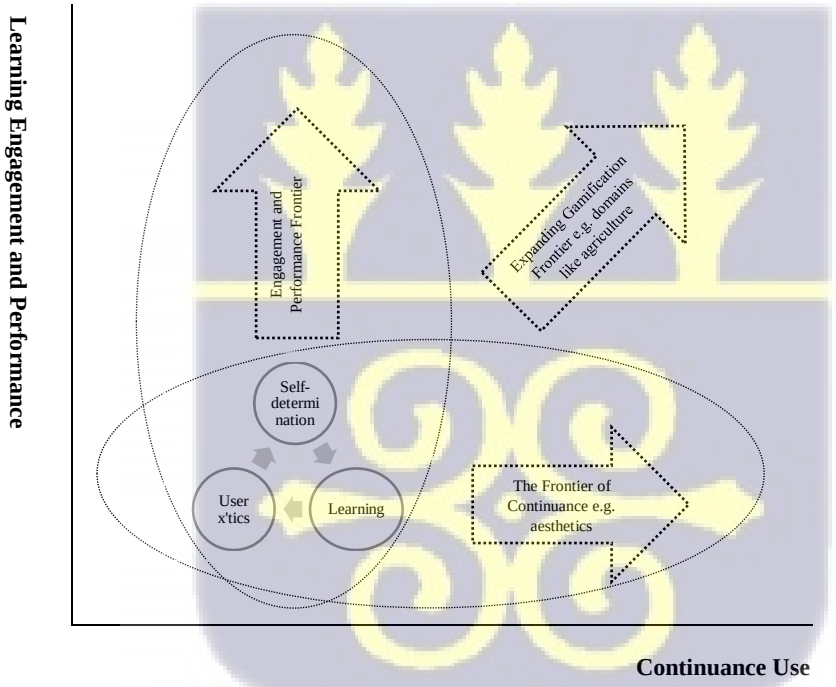


Figure 8.4 The Dimensions and Facets of Gamification Frontiers

Dimensions of Gamification Frontier	
Learning Performance and Engagement frontier	The continuous improvement in executing tasks to which gamification is applied in education
Continuance use frontier	The continuous expansion of different contexts to which gamification is applied in education
Facets of Gamification	
Self-determination	Personality in social context exhibiting autonomous but not controlled behaviour
User characteristics and usability	Being acceptable to the target audience
Learning (motivation, opportunity & ability)	Improving through user behaviour, data and experience

Notwithstanding, interest in future learning technologies would primarily focus on a) how instructors, designers, and HEIs align the technology used in the target system e.g. Sakai, blackboard and b) the choice of game design elements. However, the characteristics and attributes of the target learning technology are likely to play an important role in the choice of game elements. Developing economies HEIs should note that, without the appropriate infrastructure in the target learning system, the outcomes of gamification may be infeasible even though it has appealing characteristics for user benefit.

To avoid this pitfall, HEIs should ensure that the target technology systems have enhanced features and are easily upgradable with intelligent compatibility for unforeseeable years. This study also revealed that technology would continue to advance. The advancement would produce more opportunities for instructors and teachers to grow professionally and engage students. Subsequently, they must identify the innovation, resources, support and time to learn about new technologies to advance their teaching goals and develop best practices.

The next section provides a summary of topical priorities for policymakers that can support higher education to improve their capacity to perform technology enhanced-learning activities and research in DE. The topical priorities supported the model and is based on the three core tenants derived from the study results. In my estimation, HEI in DE will embrace at least two of these topical priorities to meaningfully engage with students in this pandemic era.

8.5.4 Topical Priorities for Policymakers in Higher Education

Learner Characteristics Purposes

- Individual difference and responsiveness to the environment
- Game-based learning and gamification is here to stay
- Online learning communities (social influence),
- Tailoring gamification, research and innovation

Learner Outcome Functions

- Autonomous learning and social relatedness
- Outreach and engagement with students and lecturers
- Platform, learning and assessment
- Student psychological and self-determination wellbeing

Learner Continuance Behaviour Development

- Learner-centred platforms and aesthetic appeal (i.e. personalisation)
- Institutional-based trust and interactivity system strengthening (expectations)
- Institutional leadership development including lecturer motivation
- National policies to incentivize the learner-centred approach in higher education functions and mission

Note: The model priorities for policymakers is that attitudes about accepting these types of platforms in education is primarily driven by their affordances i.e., psychological safety (autonomy, competence and social influence) and personality traits (PE, EE, Trust, aesthetic appeal and gamification elements) in DE HEIs.

8.6 CONCLUSION

The study explored the extent to which gamification can be integrated and accepted into learning. Thus, an extended model of UTAUT was used to support the analysis. The research model shows that students' adoption of gamification depends on performance expectancy, effort expectancy, attitude, social influence, and trust. Image and facilitating conditions of the MLR analysis proved insignificant to the student's acceptance (intention to use) of gamification in learning. Facilitating conditions such as prior exposure to computer games, accessibility, and skills positively impacted students' intention to use gamification. The significance of the study findings is to support the development of GIS for future use. Therefore, the study should inform designers of user perception and attributes of integrating gamification into learning systems.

Further, the study examined the game dynamics, psychological need satisfaction and user engagement in a gamified learning environment. The findings support the persuasive nature of game design elements in arousing students' feelings of autonomy, social relatedness and competence in a gamified learning environment using the MLearn application. The study also found a higher variance in explaining enjoyment by the three psychological needs: autonomy, competence, and relatedness. To this end, effective learning support strategies could be argued as those that address the issue of students' autonomy, competence, and relatedness in the gamified environment. Thus, individuals are intrinsically motivated when their psychological needs are fulfilled. Therefore, this study confirms that adding game elements (excitement) to educational systems may result in students' needs satisfaction and the notion of self-determination theory in predicting user motivation in education.

Additionally, this study examines the growing interest in gamification and CU of new technologies to motivate and enhance learning. This study suggests that AE and ITC have a

positive effect on CU of gamification. The findings signal that educators need to consider the education opportunities spanning from IT and the students' abilities when designing a motivational system for learning. In exploiting the potential of gamification, the study believes the O→A→M network will provide a deeper understanding of future research on factors that proactively affect students learning and CU behaviours. To conclude, designers can develop technology solutions that produce a favourable outcome for users when considering the development and the interactions between the student and the gamification system.

In conclusion, the goal of this thesis was to study the new phenomenon of gamification in developing economies like Ghana and examine students learning behaviours with gamified interactive systems. As higher education institutions pursue more motivational information systems practices in teaching and learning, understanding how to organise educators and students to contribute meaningfully to this practice would become increasingly decisive. Using a survey approach, this study developed three research models which indicate adoption, user engagement, and post-adoption behaviours (continual use) to examine the phenomenon of gamification in HEI in Ghana. The study showed proof of the gamification concept, proof of gamification's value in education, and validated gamification use. This study encourages future research to extend this work by advancing our knowledge of how gamification can encourage interactive sessions among students in different disciplines, and in turn, improve learning and teaching performances. Finally, the study proposes the HEIGC model to address the interplay between user characteristics, motivation, and GIS in determining IS enjoyment and continuance use.

The HEIGC model for gamification research should be understood as a stopgap of research performed to date in Ghana. This PhD work is the first research from the last four years and the most recent on gamification in HEI studies in DEs. It serves as a starting point for high

quality and methodologically sound gamification research in developing economies. The framework can be used as a basis for more theory-guided empirical research that is needed to promote a complete understanding of mechanisms that work best for specific learning processes and outcomes in developing economies.

8.7 RESEARCH LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

In addressing the first research objective, the study faced a number of institutional and student-based challenges. These included a lack of basic IT training for students, exposure to digital technologies, instructors' willingness to gamify courses, and embracing gamification, attractiveness, and redesign of LMS to accommodate gamification and availability of technical support. Another challenge was students' low level of trust in the institution's internet bandwidth for gamification services to be effectively implemented.

Additionally, future research can improve the constructs used in the adoption of gamification. The study found that some items in the factor analysis did not load well with the UTAUT original constructs. Therefore, the study results are not directly generalizable because the research was exploratory with a limited sample of 185 in a localised environment (Ghana). Thus, the complexity of the conceptual model for testing was also limited by the available sample size.

Future research: empirical testing of the learning management system is necessary to find out the effectiveness of the intervention. Thus, further studies should consider conducting a pre-test using the gamified system and a post-test using the gamified system and comparing the students' learning outcomes in a cross-sectional survey, e.g. assessment scores on the concepts learned to determine whether the LMS intervention is effective. Using the theoretical and reliable scale of UTAUT, the researcher hopes this study serves as one of the pioneering

research projects on gamification adoption in Ghana and provides a basis to support gamification research for learners of interactive systems.

Despite the researchers' efforts to increase the rigour of the methodological approach, the *second research objective* had some limitations. First, the study was performed at a higher education institution with a developing economy (Ghana) focus, which limits the generalisability of the results. Therefore, future research may extend this study by examining or comparing data with other disciplines, economies (cultures) and regional contexts.

Six out of the eight hypothetical relationships yielded positive results (validated) in the structural equation model, which is still inadequate to conclude a causal relationship. Furthermore, two of the relationships within the SDT research model (i.e. competence and course satisfaction, and rewards and competence) did not yield positive results. Given the scope of this study, future research should explore the structures of alternative models to ascertain how competence (self-determination), course satisfaction (intrinsic motivation) and rewards (game dynamics) interact in a gamified learning environment to engage students. By employing an experimental design approach, future research can explore the tenants of SDT to further predict user engagement with gamification in teaching and learning.

Aside from the highlighted limitations, this study is considered one of the earliest studies establishing a relationship between the tenants of SDT and game elements in the gamified learning environment in HEIs. The insights obtained in this research provide implications for gamified learning directions and support for both educators and students. This study also highlighted and broadened our knowledge of the complex nature of students' engagement, motivation, game design elements, antecedents and derivatives to HEIs in implementing gamification in education and flourishing online learning environments to complement classroom activities.

Based on the third research objective, this study identified several limitations. First, given that the study sampled university students from one university in Ghana, this study needs to be conducted across universities to generalise the results. Also, since the study's focus was on university students, the study results are not directly applicable to other demographic groups. For example, since the students' age is relatively young, their perception and experience with GIS would differ from non-student users (organisational context e.g. employees) who have higher income, and their quest for game elements would be monetary badges and points. To address the issue of generalisability, future research can replicate the study on non-students, especially in marketing or business environments. Given the increasing research in gamification and game design elements in education in other economies, studies applying MOA and continuance use intention from different contexts and economies may be beneficial to future research and practice. A longitudinal study may be more effective than a short-term study in understanding the long-term effect of learners' motivation, opportunity, and ability in leveraging IS in education. The researcher hopes this study draws attention and contributes to gamification research, mainly from the teaching and individual learner perspective.

Second, since the students were potential and current users of the gamified system, the system's excitement may favour their responses to continue using than discontinuity. Although the study did not survey discontinued users on this basis, the data on the three CU intentions from the individual-level ratings ranged from 1 to 7. Hence, the intent to discontinue the gamified use was demonstrated. Knowing that gamification is still in its infant stages, the expectation of discontinuance intention behaviours can eventually result in discontinued use. Future research is encouraged to study users over a more extended period.

Further, to present a more extensive view of the learner and the context underlying continuance use intention, an ideal empirical design for testing the OAM framework should consider

[4]integrating the aesthetic experience, information technology capability and information quality in this study with additional OAM constructs. For instance, to comprehensively capture the dynamics and interrelationships between learners' adoption and decisions regarding continuance use, future research should consider the individual's perceptions before the acceptance and after acceptance (pre and post-acceptance) of the gamified application. This study presents the opportunity for future studies to leverage the motivation, ability and opportunity constructs and relate them to interesting issues such as the student's attitude (how they perceive use) across acceptance and behaviours and the phases of continuance use intentions. *Based on the proposed framework and model*: Further, despite the good contribution of my study, data were collected from same population but different level of studies at the adoption stage, learner engagement stage and continuance use stage, which serves as a representation of the population. The reason for the different levels of studies is that gamification is at the nascent stage and UNI-GAMI had not implemented or adopted GIS across disciplines. Hence, GIS is targeted to some students based on the instructors' motivation, money, time and technology availability. The researcher calls on future research to use a unified group of students to gain a better understanding or perspective of the proposed model.

The researcher hopes that future studies will further explore the interactions between the learner and institutional factors, particularly the effect of AE, in promoting game elements CU in teaching and learning. The researcher further calls on future studies to empirically test the proposed HEIGC model, especially in developing economies and other domains other than education. Finally, notwithstanding the importance of face-to-face teaching and learning in computing education, the application of GIS in HEIs has proved to be essential during the

[4] *Data was collected from similar group of participants to address each RO. Thus, heterogeneity may not affect the generalizability of the model conclusion. Thus, the sample consisted of similar students' characteristic in one institution, with homogeneity in tasks characteristics, hence alleviating concerns about generalizability to some extent.*

current pandemic, as students look for motivation in learning systems. Although my thesis does not purport to capture all the adoption, acceptance and motivational factors that affect gamified information systems growth in developing economies, and the results could be further investigated by future research, it provides valuable insight and a significant framework within which to develop and test empirical propositions in the related education technology area.

Although, my research has contributed to literature reviews and suggested the growing interest in gamification research as evidenced in IS conferences (AMCIS and ICIS) and the IS communities (AIS Special Interest Group on Game Design and Research) and journals like the European Journal of Information Systems and Journal of Information Systems Education. There are still challenges in conducting gamification research which future studies can take it up. These include how to advance theoretical contributions to the gamification of science literature and how to ***identify novel issues of theoretical importance*** in education to avoid common pitfalls. Future research may also advance this research approach to tailoring gamification by navigating the gamification design process to boost the success rate.

I conclude with an interview (quote) I had with University World News[5] (African Edition) on 26th November 2020 on how 'Gamification of education can engage students during the Covid-19'…and I quote.. "***If COVID-19 can shut [down] an entire nation, then it's time to look at our African educational system again, especially for ways to engage students in their respective places – which to the researcher is the gamification way – harnessing the potentials of games in education."***

[5] Interview with University World News: African Edition on 26th November 2020. Access via https://www.universityworldnews.com/post.php?story=20201123063309960

REFERENCES

Adukaite, A., van Zyl, I., Er, Ş., & Cantoni, L. (2017). Teacher perceptions on the use of digital gamified learning in tourism education: The case of South African secondary schools. *Computers & Education*, *111*, 172-190.

Afful-Dadzie, E., Afful-Dadzie, A., & Egala, S. B. (2021). Social media in health communication: A literature review of information quality. *Health Information Management Journal*, 1833358321992683.

Ajzen, I. (1991). The theory of planned behaviour. *Organizational Behaviour and Human Decision Processes*, 50(2), 179-211.

Alahäivälä, T., & Oinas-Kukkonen, H. (2016). Understanding persuasion contexts in health gamification: A systematic analysis of gamified health behaviour change support systems literature. *International Journal of Medical Informatics*, *96*, 62-70.

Alexiou, A., & Schippers, M. C. (2018). Digital game elements, user experience and learning: A conceptual framework. *Education and Information Technologies*, *23*(6), 2545-2567.

Aldemir, T., Celik, B., & Kaplan, G. (2018). A qualitative investigation of student perceptions of game elements in a gamified course. *Computers in Human Behaviour*, *78*, 235-254.

Alghamdi, A., Karpinski, A. C., Lepp, A., & Barkley, J. (2020). Online and face-to-face classroom multitasking and academic performance: Moderated mediation with self-efficacy for self-regulated learning and gender. *Computers in Human Behavior*, *102*, 214-222.

Alkhawaldeh, N., & Menchaca, M. (2014). Barriers to utilizing ICT in education in Jordan. *International Journal on E-learning*, *13*(2), 127-155.

Al-Mamary, Y. H. S., Al-Nashmi, M. M., Shamsuddin, A., & Abdulrab, M. (2019). Development of an integrated model for successful adoption of management information systems in Yemeni telecommunication organizations. *International Journal of Scientific & Technology Research*, *8*(11), 3912-3939.

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: a review and recommended two-step approach. *Psychological Bulletin* 103(3), 411–423.

Ansong, E., Boateng, S., & Boateng, R. (2017). Determinants of e-learning adoption in universities: Evidence from a developing economy. *Journal of Educational Technology Systems*, *46*(1), 30-60.

Appiahene, P., Asante, G., Kesse-Yaw, B., & Acquah-Hayfron, J. (2017). Raising students programming skills using appiahene gamification model. In *ECGBL 2017 11th European Conference on Game-Based Learning* (pp. 14-21).

Aryani, E., Zahed Bablan, A., Moeinikia, M., & Khaleghkhah, A. (2020). The role of virtual social networks in the research capabilities of postgraduate students. *Interdisciplinary Journal of Virtual Learning in Medical Sciences*, *6*(2), 26-39.

Aron, A., Lewandowski Jr, G. W., Mashek, D., & Aron, E. N. (2013). The self-expansion model of motivation and cognition in close relationships. *The Oxford handbook of close relationships*, 90-115.

Akturan, U., & Tezcan, N. (2012). Mobile banking adoption of the youth market: Perceptions and intentions. *Marketing Intelligence & Planning*, *30*(4), 444–459.

Barclay, D.; Thompson, R., & Higgins, C. (1995). The partial least squares (PLS) approach to causal modeling: Personal computer adoption and use as an illustration. Technology Studies, 2, (2), 285–309.

Barnes, J., & Kennewell, S. (2017). Investigating teacher perceptions of teaching ICT in Wales. *Education and Information Technologies*, *22*(5), 2485-2497.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology*, *51*(6), 1173.

Baroudi, J. J., & Orlikowski, W. J. (1988). A short-form measure of user information satisfaction: a psychometric evaluation and notes on use. *Journal of Management Information Systems*, *4*(4), 44-59.

Barrio, C. M., Muñoz-Organero, M., & Soriano, J. S. (2015). Can gamification improve the benefits of student response systems in learning? An experimental study. *IEEE Transactions on Emerging Topics in Computing*, *4*(3), 429-438.

Barata, G., Gama, S., Jorge, J., & Gonçalves, D. (2013). Improving Participation and Learning with Gamification. In L. Nacke et al., (Ed.), *International Conference on Gameful Design, Research, and Applications* (pp. 10–17). Stratford, ON, Canada: ACM.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84(2), pp.191–215.

Bélanger, F., & Allport, C. D. (2008). Collaborative technologies in knowledge telework: an exploratory study. *Information Systems Journal*, *18*(1), 101-121.

Berkling, K., & Thomas, C. (2013). Gamification of a software engineering course, *International Conference on Interactive Collaborative Learning*, pp. 525-530.

Bhattacherjee, A. (2001). Understanding information systems continuance: an expectation-confirmation model. *MIS Quarterly*, 351-370.

Boateng, R., Boateng, S. L., Awuah, R. B., Ansong, E., & Anderson, A. B. (2016). Videos in learning in higher education: assessing perceptions and attitudes of students at the University of Ghana. *Smart Learning Environments*, *3*(1), 8.

Binde, J., & Fuksa, M. (2013). Mobile technologies and services development impact on mobile internet usage in Latvia. Management and Organisational Systems Research.67, 23–37.

Bourgonjon, J., Valcke, M., Soetaert, R., & Schellens, T. (2010). Students' perceptions about the use of video games in the classroom. *Computers & Education*, *54*(4), 1145-1156.

Bøe, T. (2018). E-learning technology and higher education: the impact of organizational trust. *Tertiary Education and Management*, *24*(4), 362-376.

Botha, A., & Herselman, M. (2017). Teachers become cocreators through participation in a teacher professional development (TPD) course in a resource constraint environment in South Africa. *The Electronic Journal of Information Systems in Developing Countries*, *84*(1), e12007.

Burke, B. (2013). Gamification: Engagement strategies for business and IT. *Report by Gartner Inc., ID: G00245563*.

Bitrián, P., Buil, I., & Catalán, S. (2021). Enhancing user engagement: The role of gamification in mobile apps. *Journal of Business Research*, *132*, 170-185.

Brockmyer, J. H., Fox, C. M., Curtiss, K. A., McBroom, E., Burkhart, K. M., & Pidruzny, J. N. (2009). The development of the Game Engagement Questionnaire: A measure of engagement in video game-playing. *Journal of Experimental Social Psychology*, *45*(4), 624-634.

Cai, S., & Xu, Y. (2011). Designing not just for pleasure: effects of website aesthetics on consumer shopping value. *International Journal of Electronic Commerce*, *15*(4), 159-188.

Calisir, F., Altin Gumussoy, C., Bayraktaroglu, A. E., & Karaali, D. (2014). Predicting the intention to use a web-based learning system: Perceived content quality, anxiety, perceived system quality, image, and the technology acceptance model. *Human Factors and Ergonomics in Manufacturing & Service Industries*, *24*(5), 515-531.

Carr, P. B., & Walton, G. M. (2014). Cues of working together fuel intrinsic motivation. *Journal of Experimental Social Psychology*, *53*, 169-184.

Chang, S. J., Van Witteloostuijn, A., & Eden, L. (2010). From the editors: Common method variance in international business research. *Journal of International Business Studies*, 41(2), 178e184.

Chang, C. M., Liu, L. W., Huang, H. C., & Hsieh, H. H. (2019). Factors influencing online hotel booking: Extending UTAUT2 with age, gender, and experience as moderators. *Information*, *10*(9), 281.

Chang, S. E., Liu, A. Y., & Shen, W. C. (2017). User trust in social networking services: A comparison of Facebook and LinkedIn. *Computers in Human Behavior*, *69*, 207-217.

Chen, W., & Hirschheim, R. (2004). A paradigmatic and methodological examination of information systems research from 1991 to 2001. *Information systems journal*, *14*(3), 197-235.

Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Van der Kaap-Deeder, J., ... & Ryan, R. M. (2015). Basic psychological need satisfaction, need frustration, and need strength across four cultures. *Motivation and Emotion*, *39*(2), 216-236.

Cheng, Y. Ming. (2011). Antecedents and consequences of e-learning acceptance. *Information Systems Journal* 21.3 (2011): 269-299.

Chin, W. W. (1998). Issues and opinion on structural equation modeling. *MIS Quarterly* 22(1), 1.

Chiou, E. K., Schroeder, N. L., & Craig, S. D. (2020). How we trust, perceive, and learn from virtual humans: The influence of voice quality. *Computers & Education*, *146*, 103756.

Chui, M., Manyika, J., Bughin, J., Dobbs, R., Roxburgh, C., Sarrazin, H., Sands, G., and Westergren, M. 2012. "The Social Economy: Unlocking Value and Productivity through Social Technologies," McKinsey Global Institute), pp. 1-170.

Chiang, C. Y., Boakye, K., & Tang, X. (2019). The Investigation of E-Learning System Design Quality on Usage Intention. *Journal of Computer Information Systems*, *59*(3), 256-265.

Chiu, C. M., Wang, E. T., Fang, Y. H., & Huang, H. Y. (2014). Understanding customers' repeat purchase intentions in B2C e-commerce: the roles of utilitarian value, hedonic value and perceived risk. *Information Systems Journal*, *24*(1), 85-114.

Chong, B., Martinsons, M. G., & Wong, M. (2004). Adoption of e-learning for work-based training: an exploratory study of the Hong Kong apparel industry. *International journal of innovation and learning*, *1*(3), 312-326.

Cohen, L., Manion, L., & Morrison, K. (2002). *Research methods in education*. Routledge.

Cohen, J. (1994). The earth is round (P-less-than.05). *American Psychologist*, 49(12), 997–1003.https://doi.org/10.1037//0003-066X.49.12.997.

Compeau, D., Higgins, C. A., & Huff, S. (1999). Social cognitive theory and individual reactions to computing technology: A longitudinal study. *MIS Quarterly*, 145-158.

Consolvo, S., McDonald, D. W., & Landay, J. A. (2009l). Theory-driven design strategies for technologies that support behavior change in everyday life. In *Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 405-414).

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1992). Extrinsic and intrinsic motivation to use computers in the workplace 1. *Journal of Applied Social Psychology*, *22*(14), 1111-1132.

Darwish, H. (2017). Gamifying the industrial engineering profession. In *Proceedings of the International Conference on Industrial Engineering and Operations Management Rabat*, Morocco.

de la Peña Esteban, F. D., Torralbo, J. A. L., Casas, D. L., & García, M. C. B. (2020). Web gamification with problem simulators for teaching engineering. *Journal of Computing in Higher Education*, *32*(1), 135-161.

Denden, M., Tlili, A., Essalmi, F., & Jemni, M. (2018). Does personality affect students' perceived preferences for game elements in gamified learning environments? In *2018 IEEE 18th International Conference on Advanced Learning Technologies (ICALT)* (pp. 111-115). IEEE.

Deci, E. L., & Ryan, RM (1985) The general causality orientations scale: self-determination in personality, *Journal of Research in Personality*, 19,109-134.

Deci, E. L., & Ryan, R. M. (2008). Facilitating optimal motivation and psychological well-being across life's domains. *Canadian Psychology/Psychologie canadienne*, *49*(1), 14.

Deci, E. L. (1975). *Intrinsic motivation*. New York: Plenum.

DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information systems research*, *3*(1), 60-95.

Delone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: a ten-year update. *Journal of management information systems*, *19*(4), 9-30.

Dellos, R. (2015). Kahoot! A digital game resource for learning. *International Journal of Instructional Technology and Distance Learning*, *12*(4), 49-52.

De-Marcos, L., Domínguez, A., Saenz-de-Navarrete, J., & Pagés, C. (2014). An empirical study comparing gamification and social networking on e-learning. *Computers & Education*, *75*, 82-91.

Denden, M., Tlili, A., Essalmi, F., & Jemni, M. (2017). Educational gamification based on personality. In *2017 IEEE/ACS 14th International Conference on Computer Systems and Applications (AICCSA)* (pp. 1399-1405). IEEE.

Deng, L., Turner, D. E., Gehling, R., & Prince, B. (2010). User experience, satisfaction, and continual usage intention of IT. *European Journal of Information Systems*, *19*(1), 60-75.

Deterding, S. (2011). Situated motivational affordances of game elements: A conceptual model. In *Gamification: Using game design elements in non-gaming contexts, a workshop at CHI*.

Deterding, S. (2015). The lens of intrinsic skill atoms: A method for gameful design. *Human Computer Interaction*, *30*(3–4), 294–335.

Deterding, S., Dixon, D., Khaled, R., & Nacke, L. (2011) Gamification: Toward a definition. In *Proceedings of the CHI 2011 Gamification Workshop.*

Devaraj, S., & Kohli, R. (2003). Performance impacts of information technology: Is actual usage the missing link?. *Management Science*, *49*(3), 273-289.

Dicheva, D., Dichev, C., Agre, G., & Angelova, G. (2015). Gamification in education: A systematic mapping study. *Educational Technology & Society*, *18*(3), 75-88.

Dichev, C., & Dicheva, D. (2017). Gamifying education: what is known, what is believed and what remains uncertain: a critical review. *International Journal of Educational Technology in Higher Education*, *14*(1), 9.

Dietz, G. (2011). Going back to the source: Why do people trust each other? *Journal of Trust Research*, *1*(2), 215-222.

D'olimpio, L. (2021). Defending aesthetic education. *British Journal of Educational Studies*, 1-17.

DomíNguez, A., Saenz-De-Navarrete, J., De-Marcos, L., FernáNdez-Sanz, L., PagéS, C., & MartíNez-HerráIz, J. J. (2013). Gamifying learning experiences: Practical implications and outcomes. *Computers & Education*, *63*, 380-392.

Easton, G. (2010). Critical realism in case study research. *Industrial marketing management*, *39*(1), 118-128.

El-Masri, M., & Tarhini, A. (2015). A design science approach to gamify education: From games to platforms. In *Proceedings of the European Conference on Information Systems.*

Ezezika, O., Oh, J., Edeagu, N., & Boyo, W. (2018). Gamification of nutrition: A preliminary study on the impact of gamification on nutrition knowledge, attitude, and behavior of adolescents in Nigeria. *Nutrition and Health*, *24*(3), 137-144.

Faraj, S., Jarvenpaa, S. L., & Majchrzak, A. (2011). Knowledge collaboration in online communities. *Organization Science*, *22*(5), 1224-1239.

Featherstone, M., & Habgood, J. (2019). UniCraft: Exploring the impact of asynchronous multiplayer game elements in gamification. *International Journal of Human-Computer Studies*, *127*, 150-168.

Filippou, J., Cheong, C., & Cheong, F. (2018). A Model to Investigate Preference for the use of Gamification in a Learning Activity. *Australasian Journal of Information Systems*, *22*.

Fink, L., and Neumann, S. (2007). Gaining agility through IT personnel capabilities: the mediating role of IT infrastructure capabilities. *Journal of the Association for Information Systems* 8(8), 440–462.

Finstad, K. (2010). Response interpolation and scale sensitivity: Evidence against 5-point scales. *Journal of usability studies*, *5*(3), 104-110.

Fink, L. (2011). How do IT capabilities create strategic value? Toward greater integration of insights from reductionistic and holistic approaches. *European Journal of Information Systems*, *20*(1), 16-33.

Fitz-Walter, Z. J. (2015). *Achievement unlocked: Investigating the design of effective gamification experiences for mobile applications and devices* (Doctoral dissertation, Queensland University of Technology).

Fishbein, M., Triandis, H.C., Kanfer, F.H., Becker, M., Middlestadt, S.E., & Eichler, A. (2001). Factors influencing behaviour and behaviour change. *Handbook of health psychology* (pp. 3–17). Mahwah, NJ: Lawrence Erlbaum Associates.

Fogg, B.J. (2003). *Persuasive Technology: Using Computers to Change What We Think and Do*. Morgan Kaufmann.

Fornell, C., and Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research* 18(1), 39–50.

Folmar, D. (2015). *Game it Up!: Using Gamification to Incentivize Your Library* (Vol. 7). Rowman and Littlefield.

Fullan, M. (2014). *Teacher development and educational change*. Routledge.

Gibson, D., Ostashewski N, Flintoff K, Grant S and Knight E. (2015) Digital badges in education, *Education and Information Technology*, Vol. 20 No. 2, pp. 403-410, available at https://doi.org/10. 1007/s10639-013-9291-7

Gist, M. E., & Mitchell, T. R. (1992). Self-efficacy: A theoretical analysis of its determinants and malleability. *Academy of Management Review*, *17*(2), 183-211.

Gorla, N., Somers, T. M., & Wong, B. (2010). Organizational impact of system quality, information quality, and service quality. *The Journal of Strategic Information Systems*, *19*(3), 207-228.

Göksün, D. O., & Gürsoy, G. (2019). Comparing success and engagement in gamified learning experiences via Kahoot and Quizizz. *Computers & Education*, *135*, 15-29.

Goldhill, J., & Roodt, S. (2018). Gamification in m-Health Applications and its Effects on Health Behavioural Changes in Net Generation Students. In *2018 International Conference on Intelligent and Innovative Computing Applications (ICONIC)* (pp. 1-7). IEEE.

Granić, A., & Marangunić, N. (2019). Technology acceptance model in educational context: A systematic literature review. *British Journal of Educational Technology*, *50*(5), 2572-2593.

Guba, E. G., &Lincoln, Y.S. (1994), Competing Paradigms in Qualitative Research, in NK.

Hair, J. F. Jr., Babin, B., Money, A. H. & Samouel, P. (2003). *Essentials of business research methods*. New York: Wiley.

Hair, J. F, Ringle C. M., and Starstedt, M. (2011) PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice* 19(2), 139–151.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*.

Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the academy of marketing science*, *40*(3), 414-433.

Hakak, S., Noor, N. F. M., Ayub, M. N., Affal, H., Hussin, N., & Imran, M. (2019). Cloud-assisted gamification for education and learning–Recent advances and challenges. *Computers & Electrical Engineering*, *74*, 22-34.

Hamari, J., Koivisto, J., & Sarsa, H. (2014). Does Gamification Work? -A Literature Review of Empirical Studies on Gamification. In *HICSS* (Vol. 14, No. 2014, pp. 3025-3034).

Hamari, J., Sjöklint, M., & Ukkonen, A. (2016). The sharing economy: Why people participate in collaborative consumption. *Journal of the association for information science and technology*, *67*(9), 2047-2059.

Hamari, J., Shernoff, D. J., Rowe, E., Coller, B., Asbell-Clarke, J., & Edwards, T. (2016). Challenging games help students learn: An empirical study on engagement, flow and immersion in game-based learning. *Computers in Human Behavior*, *54*, 170-179.

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

Hartmann, T., & Klimmt, C. (2006). Gender and computer games: Exploring females' dislikes. *Journal of Computer-Mediated Communication*, *11*(4), 910-931.

Harter, J. K., Schmidt, F. L., & Hayes, T. L. (2002). Business-unit-level relationship between employee satisfaction, employee engagement, and business outcomes: a meta-analysis. *Journal of Applied Psychology*, *87*(2), 268.

He, J., & Freeman, L. A. (2010). Are men more technology-oriented than women? The role of gender on the development of general computer self-efficacy of college students. Journal of Information Systems Education, 21(2), 203-212.

Hense, J., & Mandl, H. (2014). Learning in or with Games?. In *Digital systems for open access to formal and informal learning* (pp. 181-193). Springer, Cham.

Henseler, J., Ringle, C. M., & Sinkovics, R. R. (2009). The use of partial least squares path modeling in international marketing. In *New challenges to international marketing*. Emerald Group Publishing Limited.

Hew, K. F., Huang, B., Chu, K. W. S., & Chiu, D. K. (2016). Engaging Asian students through game mechanics: Findings from two experiment studies. *Computers & Education*, *92*, 221-236.

Hofstede, G., & Hofstede, J. (2005). *Cultures and organizations: Software of the mind*. New York, NY: McGraw-Hill.

Hofacker, C. F., De Ruyter, K., Lurie, N. H., Manchanda, P., & Donaldson, J. (2016). Gamification and mobile marketing effectiveness. *Journal of Interactive Marketing*, *34*, 25-36.

Holzer, A., Kocher, B., Bendahan, S., Vonèche Cardia, I., Mazuze, J., & Gillet, D. (2020). Gamifying knowledge sharing in humanitarian organisations: a design science journey. *European Journal of Information Systems*, *29*(2), 153-171.

Huang, W.-H. D., Hood, D. W., & Yoo, S. J. (2012). Gender divide and acceptance of collaborative Web 2.0 applications for learning in higher education. *The Internet and Higher Education*, 16, 57-65.

Huang, Z. & Cappel, J. J. (2005). Assessment of Web-Based Learning Game in an Information Systems Course. *Journal of Computer Information Systems*, 45, 42-50.

Hughes, J. (2007). The ability-motivation-opportunity framework for behavior research in IS. In *2007 40th Annual Hawaii International Conference on System Sciences (HICSS'07)* (pp. 250a-250a). IEEE.

Hsu, M. H., Ju, T. L., Yen, C. H., & Chang, C. M. (2007). Knowledge sharing behavior in virtual communities: The relationship between trust, self-efficacy, and outcome expectations. *International journal of human-computer studies*, *65*(2), 153-169.

Ismail, M. E., Sa'adan, N., Samsudin, M. A., Hamzah, N., Razali, N., & Mahazir, I. I. (2018). Implementation of The Gamification Concept Using Kahoot! Among TVET Students: An Observation. In *Journal of Physics: Conference Series*. IOP Publishing.

Jahn, K., Kordyaka, B., Machulska, A., Eiler, T. J., Gruenewald, A., Klucken, T., ... & Niehaves, B. (2021). Individualized gamification elements: The impact of avatar and feedback design on reuse intention. *Computers in Human Behavior*, *119*, 106702.

Jang, H., Reeve, J., Ryan, R. M., & Kim, A. (2009). Can self-determination theory explain what underlies the productive, satisfying learning experiences of collectivistically oriented Korean students?. *Journal of Educational Psychology*, *101*(3), 644.

Janssen, M., Charalabidis, Y., & Zuiderwijk, A. (2012). Benefits, adoption barriers and myths of open data and open government. *Information systems management*, *29*(4), 258-268.

Janson, A., Söllner, M., & Leimeister, J. M. (2017). Individual appropriation of learning management systems—antecedents and consequences. *AIS Transactions on Human-Computer Interaction*, *9*(3), 173-201.

Jasperson, J. S., Carter, P. E., & Zmud, R. W. (2005). A comprehensive conceptualization of post-adoptive behaviors associated with information technology enabled work systems. *MIS Quarterly*, *29*(3), 525-557.

Jennings, M. (2000). Theory and models for creating engaging and immersive ecommerce websites. In *Proceedings of the 2000 ACM SIGCPR conference on Computer personnel research* (pp. 77-85). ACM.

Jeno, L. M., Adachi, P. J., Grytnes, J. A., Vandvik, V., & Deci, E. L. (2019). The effects of m-learning on motivation, achievement and well-being: A Self-Determination Theory approach. *British Journal of Educational Technology*, *50*(2), 669-683.

Jiang, Z., Wang, W., Tan, B. C., & Yu, J. (2016). The determinants and impacts of aesthetics in users' first interaction with websites. *Journal of Management Information Systems*, *33*(1), 229-259.

Kankanhalli, A., Tan, B. C., & Wei, K. K. (2005). Contributing knowledge to electronic knowledge repositories: An empirical investigation. *MIS Quarterly*, *29*(1).

Kankanhalli, A., Taher, M., Cavusoglu, H., & Kim, S. H. S. (2012). Gamification: A New Paradigm for Online User Engagement, in *Proceedings of the 33rd International Conference on Information Systems*, Orlando, FL.

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of Social Media. *Business Horizons*, *53*(1), 59-68.

Karahanna, E., Xu, S. X., Xu, Y., & Zhang, N. A. (2018). The needs–affordances–features perspective for the use of social media. *Mis Quarterly*, *42*(3), 737-756.

Kettinger, W. J., Li, Y., Davis, J. M., & Kettinger, L. (2015). The roles of psychological climate, information management capabilities, and IT support on knowledge-sharing: an MOA perspective. *European Journal of Information Systems*, *24*(1), 59-75.

Ketelhut, D. J., & Schifter, C. C. (2011). Teachers and game-based learning: Improving understanding of how to increase efficacy of adoption. *Computers & Education*, *56*(2), 539-546.

Khechine, H., Lakhal, S., & Ndjambou, P. (2016). A meta-analysis of the UTAUT model: Eleven years later. *Canadian Journal of Administrative Sciences/Revue Canadienne des Sciences de l'Administration*, *33*(2), 138-152.

Kim, B., & Han, I. (2011). The role of utilitarian and hedonic values and their antecedents in a mobile data service environment. *Expert Systems with Applications*, *38*(3), 2311-2318.

Kim, H. W., Chan, H. C., & Kankanhalli, A. (2012). What motivates people to purchase digital items on virtual community websites? The desire for online self-presentation. *Information systems research*, *23*(4), 1232-1245.

King, W. R. (2003). IT capabilities, business processes, and impact on the bottom line. In *IS Management Handbook* (BROWN CV and TOPI H, Eds), pp 21–24, Auerbach, Boca Raton, FL.

Klecun, E., Lichtner, V., Cornford, T., & Petrakaki, D. (2014). Evaluation as a Multi-Ontological Endeavour: A Case from the English National Program for IT in Healthcare. *Journal of the Association for Information Systems*, *15*(3), 147-176.

Kline, R. B. (2011). *Principles and practice of structural equation modeling (3rd ed.).* New York: Guilford Press.

Koivisto, J., & Hamari, J. (2019). The rise of motivational information systems: A review of gamification research. *International Journal of Information Management*, *45*, 191-210.

Kolog, E. A., Sutinen, E., Vanhalakka-Ruoho, M., Suhonen, J., & Anohah, E. (2015). Using unified theory of acceptance and use of technology model to predict students' behavioral

intention to adopt and use E-counseling in Ghana. *International Journal of Modern Education and Computer Science*, *7*(11), 1-11.

Kuhn, T. S. (1970). *The Structure of Scientific Revolutions*, University of Chicago Press, Chicago.

Kumar, R. (2019). *Research methodology: A step-by-step guide for beginners*. Sage Publications Limited.

Kumar, B., & Khurana, P. (2012). Gamification in education: learn computer programming with fun, *International Journal of Computers and Distributed Systems*, Vol. 2 No. 1, pp. 46-53.

Kunter, M., & Baumert, J. (2006). Who is the expert? Construct and criteria validity of student and teacher ratings of instruction. *Learning Environments Research*, *9*(3), 231-251.

Lai, H. M., Hsiao, Y. L., & Hsieh, P. J. (2018). The role of motivation, ability, and opportunity in university teachers' continuance use intention for flipped teaching. *Computers & Education*, *124*, 37-50

Leclercq, T., Poncin, I., & Hammedi, W. (2017). The engagement process during value co-creation: gamification in new product-development platforms. *International Journal of Electronic Commerce*, *21*(4), 454-488.

Lee, D. M. S., Trauth, E. M., & Farwell, D. (1995). Critical skills and knowledge requirements of IS professionals: a joint academic/industry investigation. *MIS Quarterly* 19(3), 313–340.

Lee, C. L., & Yang, H. J. (2011). Organization structure, competition and performance measurement systems and their joint effects on performance. *Management accounting research*, *22*(2), 84-104.

Lee, J. J., Ceyhan, P., Jordan-Cooley, W., & Sung, W. (2013). GREENIFY: A real world action game for climate change education. *Simulation & Gaming*, *44*(2–3), 349–365.

Lee, J., & Hammer, J. (2011). Gamification in Education: What, How, Why Bother? *Academic Exchange Quarterly*, *15*(2), 146.

Legaki, N. Z., Karpouzis, K., Assimakopoulos, V., & Hamari, J. (2021). Gamification to avoid cognitive biases: An experiment of gamifying a forecasting course. *Technological Forecasting and Social Change*, *167*, 120725.

Leung, C. H. (2011). An experimental study of eduplay and social competence among preschool students in Hong Kong. *Early Child Development and Care*, *181*(4), 535-548.

Li, W. (2021). The role of trust and risk in citizens' E-government services adoption: a perspective of the extended UTAUT model. *Sustainability*, *13*(14), 7671.

Liao, H. L., & Lu, H. P. (2008). The role of experience and innovation characteristics in the adoption and continued use of e-learning websites. *Computers & Education*, *51*(4), 1405-1416.

Lincoln, Y. S., Lynham, S. A., & Guba, E. G. (2011). Paradigmatic controversies, contradictions, and emerging confluences, revisited. *The Sage handbook of qualitative research*, *4*, 97-128.

Liu, D., Santhanam, R., & Webster, J. (2017). Towards meaningful engagement: A framework for design and research on gamified information systems. *MIS Quarterly, 41*(4), 1011–1034.

Liu, Y., Alexandrova, T., & Nakajima, T. (2011). Gamifying intelligent environments. In: Proceedings of the 2011 *International ACM Workshop on Ubiquitous Meta User Interfaces*. ACM, New York, NY, USA, pp. 7–12.

Lowry, P. B., & Gaskin, J. (2014). Partial least squares (PLS) structural equation modelling (SEM) for building and testing behavioural causal theory: When to choose it and how to use it. *IEEE transactions on professional communication*, *57*(2), 123-146.

McAuley, E., Duncan, T., & Tammen, V. V. (1989). Psychometric properties of the Intrinsic Motivation Inventory in a competitive sport setting: A confirmatory factor analysis. *Research quarterly for exercise and sport*, *60*(1), 48-58.

Maclnnis, D. J., & Jaworski, B. J. (1989). Information processing from advertisements: Toward an integrative framework. *Journal of Marketing*, *53*(4), 1-23.

Maclnnis, D. J., Moorman, C., & Jaworski, B. J. (1991). Enhancing consumers' motivation, ability, and opportunity to process brand information from ads: conceptual framework and managerial implications. *Journal of Marketing*, *55*(1), 32-53.

Majchrzak, A., & Malhotra, A. (2013). Towards an information systems perspective and research agenda on crowdsourcing for innovation. *The Journal of Strategic Information Systems*, *22*(4), 257-268.

Martins, C., Oliveira, T., & Popovič, A. (2014). Understanding the Internet banking adoption: A unified theory of acceptance and use of technology and perceived risk application. *International Journal of Information Management*, *34*(1), 1-13.

Ma, M., & Agarwal, R. (2007). Through a glass darkly: Information technology design, identity verification, and knowledge contribution in online communities. *Information Systems Research*, *18*(1), 42-67.

Magni, M., Taylor, M. S., & Venkatesh, V. (2010). 'To play or not to play': A cross-temporal investigation using hedonic and instrumental perspectives to explain user intentions to explore a technology. *International journal of human-computer studies*, *68*(9), 572-588.

Markets & Markets. Gamification market. (2016). Retrieved from www.marketsandmarkets.com/Market-Reports/gamification-market-991.html (Accessed: 7 April 2019).

Maruping, L. M., Bala, H., Venkatesh, V., & Brown, S. A. (2017). Going beyond intention: Integrating behavioral expectation into the unified theory of acceptance and use of technology. *Journal of the Association for Information Science and Technology*, *68*(3), 623-637.

Marlow, J., Dabbish, L., & Herbsleb, J. (2013). Impression formation in online peer production: activity traces and personal profiles in github. In *Proceedings of the 2013 conference on Computer supported cooperative work* (pp. 117-128).

Mattingly, B. A., & Lewandowski, Jr, G. W. (2013). The power of one: Benefits of individual self-expansion. *The Journal of Positive Psychology*, *8*(1), 12-22.

Mazana, Y. M., Suero Montero, C., & Olifage, C. R. (2019). Investigating students' attitude towards learning mathematics. *International Electronic Journal of Mathematics Education.* 14(1), 207-231

McInerney, D. M., & Van Etten, S. (2004). *Big theories revisited: Research on sociocultural influences on motivation and learning* (Vol. 4). Greenwich, CT: Information Age.

McKnight, D. H., Choudhury, V., & Kacmar, C. (2002). The impact of initial consumer trust on intentions to transact with a web site: a trust building model. *The journal of strategic information systems*, *11*(3-4), 297-323.

Mekler, E. D., Brühlmann, F., Tuch, A. N., & Opwis, K. (2017). Towards understanding the effects of individual gamification elements on intrinsic motivation and performance. *Computers in Human Behavior*, *71*, 525-534.

Michie, S., Johnston, M., Francis, J., Hardeman, W., & Eccles, M. (2008). From theory to intervention: mapping theoretically derived behavioural determinants to behaviour change techniques. *Applied psychology*, *57*(4), 660-680.

Mikka-Muntuumo, J., Peters, A., & Jazri, H. (2018). CyberBullet-Share Your Story: an interactive game for stimulating awareness on the harm and negative effects of the internet. In *Proceedings of the Second African Conference for Human-Computer Interaction: Thriving Communities* (p. 54). ACM.

Miles, J. A. (2012). *Management and organization theory: A Jossey-Bass reader*. John Wiley & Sons.

Ministry of Education. (2018). Education Strategic Plan 2018-2030 Retrieved August 25, 2019, from http://moe.gov.gh/edge/content/uploads/2019/05/Education-Strategic-Plan-2018-2030.pdf

Mloza-Banda, C., & Scholtz, B. (2017). A gamified system for learning enterprise resource planning systems: Investigating the user experience. In *2017 1st International Conference on Next Generation Computing Applications (NextComp)* (pp. 209-214). IEEE.

Moffitt, R. L., Padgett, C., & Grieve, R. (2020). Accessibility and emotionality of online assessment feedback: Using emoticons to enhance student perceptions of marker competence and warmth. *Computers & Education*, *143*, 103654.

Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research*, 2, 192–222.

Morris, M. G., & Venkatesh, V. (2000). Age differences in technology adoption decisions: Implications for a changing workforce. *Personnel Psychology*, *53*(2), 375-403.

Mostakhdemin-Hosseini, A. (2009). Analysis of Pedagogical Considerations of M-Learning in Smart Devices. *International Journal of Interactive Mobile Technologies*, *3*(4).

Nah, F. F. H., Eschenbrenner, B., Claybaugh, C. C., & Koob, P. B. (2019). Gamification of Enterprise Systems. *Systems*, *7*(1), 13.

Nacke, L. E., & Deterding, C. S. (2017). The maturing of gamification research. *Computers in Human Behaviour*, 450-454.

Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2017). Digital Innovation Management: Reinventing innovation management research in a digital world. *MIS Quarterly*, *41*(1).

Nardi, B. (2010). *My life as a night elf priest: An anthropological account of World of Warcraft*. University of Michigan Press.

Nelson, R. R., Todd, P. A., & Wixom, B. H. (2005). Antecedents of information and system quality: an empirical examination within the context of data warehousing. *Journal of Management Information Systems*, *21*(4), 199-235.

Neufeld, D. J., Dong, L., & Higgins, C. (2007). Charismatic leadership and user acceptance of information technology. *European Journal of Information Systems*, *16*(4), 494-510.

Neumann, S., & Fink, L. (2007). Gaining agility through IT personnel capabilities: The mediating role of IT infrastructure capabilities. *Journal of the Association for Information Systems*, *8*(8), 25.

Ng, T. W., Sorensen, K. L., & Eby, L. T. (2006). Locus of control at work: a meta-analysis. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, *27*(8), 1057-1087.

Ngampornchai, A., & Adams, J. (2016). Students' acceptance and readiness for E-learning in Northeastern Thailand. *International Journal of Educational Technology in Higher Education*, *13*(1), 34.

Nicholson. S. (2012). Strategies for meaningful gamification: Concepts behind transformative play and participatory museums. *Meaningful Play*.

Nkwo, M., & Orji, R. (2018). Persuasive technology in African context: deconstructing persuasive techniques in an African online marketplace. In *Proceedings of the Second African Conference for Human Computer Interaction: Thriving Communities* (pp. 1-10).

Norman, D.A. (2004). *Emotional Design: Why We Love (Or Hate) Everyday Things*. New York: Basic Books.

Nousiainen, T., Kangas, M., Rikala, J., & Vesisenaho, M. (2018). Teacher competencies in game-based pedagogy. *Teaching and Teacher Education*, *74*, 85-97.

Nunnally, J. (1978). *Psychometric theory*. New York, NY: McGraw.

O'Brien, H. L., & Toms, E. G. (2008). What is user engagement? A conceptual framework for defining user engagement with technology. *Journal of the American Society for Information Science and Technology*, *59*(6), 938-955.

Ogiemwonyi, O., Harun, A., Othman, B., Ismael, D., Alam, M. N., & Hamawandy, N. M. (2020). Analyzing issues and challenges on environmentally supportive behaviour among Malaysian and Nigerian Consumers. *Sci. Int.(Lahore), ISSN*, 1013-5316.

Orji, R. (2014). *Design for Behaviour Change: A Model-driven Approach for Tailoring Persuasive Technologies* (Doctoral dissertation, University of Saskatchewan).

Orlikowski, W. J., & Baroudi, J. J. (1991). Studying information technology in organizations: Research approaches and assumptions. *Information systems research*, *2*(1), 1-28.

Ozturk, A.B., Bilgihan, A., Salehi-Esfahani, S., & Hua, N. (2017). Understanding the mobile payment technology acceptance based on valence theory: a case of restaurant transactions. *International Journal of Contemporary Hospitality Management*, 29 (8), 2027-2049.

Panda, S., & Rath, S. K. (2021). Information technology capability, knowledge management capability, and organizational agility: The role of environmental factors. *Journal of Management & Organization*, *27*(1), 148-174.

Parra-González, M. E., López-Belmonte, J., Segura-Robles, A., & Moreno-Guerrero, A. J. (2021). Gamification and flipped learning and their influence on aspects related to the teaching-learning process. *Heliyon*, *7*(2), e06254.

Pelopida, P., & Kokkinaki, A. I. (2014). Employing gameful design and development for an open educational resource on anti-plagiarism. In *Proceedings of the 8th Mediterranean Conference on Information Systems.*

Pearce, T. C., & Wood, B. E. (2019). Education for transformation: An evaluative framework to guide student voice work in schools. *Critical Studies in Education*, *60*(1), 113-130.

Pinsonneault, A., & Kraemer, K. (1993). Survey research methodology in management information systems: an assessment. *Journal of Management Information Systems*, *10*(2), 75-105.

Plump, C. M., & LaRosa, J. (2017). Using Kahoot! in the classroom to create engagement and active learning: A game-based technology solution for eLearning novices. *Management Teaching Review*, *2*(2), 151-158.

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

Rai, R. S., & Selnes, F. (2019). Conceptualizing task-technology fit and the effect on adoption–A case study of a digital textbook service. *Information & Management*, *56*(8), 103161.

Raeder, F., Karbach, L., Struwe, H., Margraf, J., & Zlomuzica, A. (2019). Low perceived self-efficacy impedes discriminative fear learning. *Frontiers in Psychology*, 1191.

Rahi, S., & Abd. Ghani, M. (2019). Does gamified elements influence on user's intention to adopt and intention to recommend internet banking? *The International Journal of Information and Learning Technology*, *36*(1), 2-20.

Rapp, A. (2022). Time, engagement and video games: How game design elements shape the temporalities of play in massively multiplayer online role-playing games. *Information Systems Journal*, *32*(1), 5-32.

Ravichandran, T., Lertwongsatien, C., & Lertwongsatien, C. (2005). Effect of information systems resources and capabilities on firm performance: A resource-based perspective. *Journal of management information systems*, *21*(4), 237-276.

Raymer, R. (2011). Gamification: using game mechanics to enhance eLearning, *eLearn Magazine*. available at: http://elearnmag.acm.org/featured.cfm?aid=2031772

Reeve, J. (2002). Self-determination theory applied to educational settings. In E. L. Deci & R. M. Ryan (Eds.). *Handbook of self-determination research* (pp. 183-203). Rochester, NY: University of Rochester Press.

Rigby, S., & Ryan, R. M. (2011). *Glued to games: How video games draw us in and hold us spellbound: How video games draw us in and hold us spellbound*. AbC-CLIo.

Robey, D., Anderson, C., & Raymond, B. (2013). Information technology, materiality, and organizational change: A professional odyssey. *Journal of the Association for Information Systems*, *14*(7), 1.

Rogers, E. (2003). *Diffusion of innovation*, 5th Edition, New York: The Free Press.

Ross, J. W., Beath, C. M., & Goodhue, D. L. (1996). Develop long-term competitiveness through IT assets. *Sloan Management Review*, *38*(1), 31-42.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68.

UNESCO & UNICEF (2020). *COVID-19: Socio-Economic Impact in Ghana: Impact on Ghana's Education* (Briefing Note No. 3). Retrieved from https://www.unicef.org/ghana/sites/unicef.org.ghana/files/2020-05/No3_%20UN%20Ghana%20COVID-19%20Briefing%20Note_2020_05_11_FINAL%20v2.pdf

Wang, Y. S., Wu, M. C., & Wang, H. Y. (2009). Investigating the determinants and age and gender differences in the acceptance of mobile learning. British Journal of Educational Technology, 40(1), 92-118.

Walsham, G. (2006). Doing interpretive research. *European Journal of Information Systems*, *15*(3), 320-330.

Webster, J., & Watson, R. T. (2002). Analyzing the past to prepare for the future: Writing a literature review. *MIS Quarterly, 26*(2), xiii-xxiii.

Werbach, K. (2014). (Re) defining gamification: A process approach. In *International Conference on Persuasive Technology* (pp. 266-272). Springer, Cham.

Werbach, K., & Hunter, D. (2012). *For the win: How game thinking can revolutionize your business*. Wharton Digital Press.

Wu, Y. L & Wang, W. T. (2014). Understanding the effects of mobile gamification on learning performance. In *Proceedings of the 20th Americas Conference on Information Systems.*

Sailer, M., Hense, J. U., Mayr, S. K., & Mandl, H. (2017). How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction. *Computers in Human Behavior*, *69*, 371-380.

Sailer, M., & Sailer, M. (2021). Gamification of in-class activities in flipped classroom lectures. *British Journal of Educational Technology*, *52*(1), 75-90.

Saleem, A. N., Noori, N. M., & Ozdamli, F. (2021). Gamification applications in E-learning: A literature review. *Technology, Knowledge and Learning*, 1-21.

Salam, M., & Farooq, M. S. (2020). Does sociability quality of web-based collaborative learning information system influence students' satisfaction and system usage?. *International Journal of Educational Technology in Higher Education*, *17*(1), 1-39.

Santhanam, R., Liu, D., & Shen, W. C. M. (2016). Research Note—Gamification of technology-mediated training: Not all competitions are the same. *Information Systems Research*, *27*(2), 453-465.

Sarker, S & Lee, A. S. (2000). Using a Positivist Case Research Methodology to Test Three Competing Theories-in-Use of Business Process Redesign, *Proceedings of the International Conference on Information Systems*, Brisbane.

Sarker, S., and Lee, A. (1998). Using a positivist case research methodology to test a theory about IT-enabled business process redesign, *International Conference on Information Systems*, pp.237–252.

Saunders, M., Lewis, P. & Thornhill, A. (2009). Research methods for business students. (4th ed.) Prentice-Hall, UK.

Scrimshaw, P. (2004). Enabling teachers to make successful use of ICT. Retrieved August 25, 2019, from http://www.becta.org.uk

Schuetz, S., & Venkatesh, V. (2020). Blockchain, adoption, and financial inclusion in India: Research opportunities. *International Journal of Information Management*, *52*, 101936.

Scott, W.R. & Davis, G.F. (2015). Organizations and Organizing: Rational, Natural and Open Systems Perspectives, Routledge, London.

Setia, P., Setia, P., Venkatesh, V., & Joglekar, S. (2013). Leveraging digital technologies: How information quality leads to localized capabilities and customer service performance. *MIS Quarterly*, 565-590.

Shanks, G. G., & Parr, A. N. (2003). Positivist single case study research in information systems: a critical analysis. In *ECIS* (pp. 1760-1774).

Shen, C. X., Liu, R. D., & Wang, D. (2013). Why are children attracted to the Internet? The role of need satisfaction perceived online and perceived in daily real life. *Computers in Human Behavior*, *29*(1), 185-192.

Siemsen, E., Roth, A. V., & Balasubramanian, S. (2008). How motivation, opportunity, and ability drive knowledge sharing: The constraining-factor model. *Journal of Operations Management*, *26*(3), 426-445.

Siponen, M., & Baskerville, R. L. (2018). Intervention effect rates as a path to research relevance: Information systems security example. *Journal of the Association for Information Systems*, *19*(4).

Son, M., & Han, K. (2011). Beyond the technology adoption: Technology readiness effects on post-adoption behavior. *Journal of Business Research*, *64*(11), 1178-1182.

Sørebø, Ø., Halvari, H., Gulli, V. F., & Kristiansen, R. (2009). The role of self-determination theory in explaining teachers' motivation to continue to use e-learning technology. *Computers & Education*, *53*(4), 1177-1187.

Standage, M., Duda, J. L., & Ntoumanis, N. (2005). A test of self-determination theory in school physical education. *British Journal of Educational Psychology*, *75*(3), 411-433.

Stopfer, J. M., Egloff, B., Nestler, S., & Back, M. D. (2014). Personality expression and impression formation in online social networks: An integrative approach to understanding the processes of accuracy, impression management and meta-accuracy. *European Journal of Personality*, *28*(1), 73-94.

Subhash, S., & Cudney, E. A. (2018). Gamified learning in higher education: A systematic review of the literature. *Computers in Human Behavior*, *87*, 192-206.

Suh, A., Wagner, C., & Liu, L. (2018). Enhancing user engagement through gamification. *Journal of Computer Information Systems*, *58*(3), 204-213.

Suh, A., Cheung, C. M., Ahuja, M., & Wagner, C. (2017). Gamification in the workplace: The central role of the aesthetic experience. *Journal of Management Information Systems*, *34*(1), 268-305.

Suppan, M., Gartner, B., Golay, E., Stuby, L., White, M., Cottet, P., ... & Suppan, L. (2020). Teaching adequate prehospital use of personal protective equipment during the COVID-19 pandemic: development of a gamified e-learning module. *JMIR Serious Games*, *8*(2), e20173.

Šumak, B., Polancic, G., & Hericko, M. (2010). An empirical study of virtual learning environment adoption using UTAUT. In *2010 Second International Conference on Mobile, Hybrid, and Online Learning* (pp. 17-22). IEEE.

Sung, Y. T., Chang, K. E., & Liu, T. C. (2016). The effects of integrating mobile devices with teaching and learning on students' learning performance: A meta-analysis and research synthesis. *Computers & Education*, *94*, 252-275.

Sun, Y., Bhattacherjee, A., & Ma, Q. (2009). Extending technology usage to work settings: The role of perceived work compatibility in ERP implementation. *Information & Management*, *46*(6), 351-356.

Tanriverdi, H. (2005). Information technology relatedness, knowledge management capability, and performance of multibusiness firms. *MIS Quarterly*, 311-334.

Tarhini, A., Hone, K., & Liu, X. (2014). Measuring the moderating effect of gender and age on e-learning acceptance in England: A structural equation modeling approach for an extended technology acceptance model. *Journal of Educational Computing Research*, *51*(2), 163-184.

Terzis, V., & Economides, A. A. (2011). Computer based assessment: Gender differences in perceptions and acceptance. Computers in Human Behavior, 27(6), 2108-2122.

Thompson, R., Barclay, D. W., & Higgins, C. A. (1995). The partial least squares approach to causal modeling: Personal computer adoption and use as an illustration. *Technology studies: special issue on research methodology*, *2*(2), 284-324.

Turkay, S., Hoffman, D., Kinzer, C. K., Chantes, P., & Vicari, C. (2014). Toward understanding the potential of games for learning: Learning theory, game design characteristics, and situating video games in classrooms. *Computers in the Schools*, *31*(1-2), 2-22.

UNICEF Ghana Report (2017). *"Handwashing with Ananse." Evaluating the effectiveness of a game-based handwashing curriculum to generate learning and behaviour change*. Retrieved from: https://www.unicef.org/ghana/HWWA_Evaluation_White_Paper.pdf. Accessed on 8 Jan 2019.

Urbach, N., & Ahlemann, F. (2010). Structural equation modelling in information systems research using partial least squares. *Journal of Information technology theory and application*, *11*(2), 5-40.

van Roy, R., & Zaman, B. (2019). Unravelling the ambivalent motivational power of gamification: A basic psychological needs perspective. *International Journal of Human-Computer Studies*, *127*, 38-50.

van Roy, R., & Zaman, B. (2017). Why gamification fails in education and how to make it successful: introducing nine gamification heuristics based on self-determination theory. In *Serious Games and edutainment applications* (pp. 485-509). Springer, Cham.

Vanduhe, V. Z., Nat, M., & Hasan, H. F. (2020). Continuance intentions to use gamification for training in higher education: Integrating the technology acceptance model (TAM), social motivation, and task technology fit (TTF). *IEEE Access*, *8*, 21473-21484.

Vatanasakdakul, S., Aoun, C., & Putra, Y. H. S. (2020). Social Media in Micro-Enterprises: Exploring Adoption in the Indonesian Retail Sector. *Journal of Global Information Management (JGIM)*, *28*(3), 184-203.

Venkatesh, V., Brown, S. A., & Bala, H. (2013). Bridging the qualitative-quantitative divide: Guidelines for conducting mixed methods research in information systems. *MIS Quarterly*, 21-54.

Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS Quarterly*, 157-178.

Venkatesh, V., Thong, J. Y., & Xu, X. (2016). Unified theory of acceptance and use of technology: A synthesis and the road ahead. *Journal of the Association for Information Systems*, *17*(5), 328-376.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27, 425–478.

Wang, X., Goh, D. H. L., Lim, E. P., Vu, A. W. L., & Chua, A. Y. K. (2017). Examining the effectiveness of gamification in human computation. *International Journal of Human–Computer Interaction*, *33*(10), 813-821.

Wang, X., & Li, Y. (2016). Users' satisfaction with social network sites: A self-determination perspective. *Journal of Computer Information Systems*, *56*(1), 48-54.

Wang, A. I., & Tahir, R. (2020). The effect of using Kahoot! for learning–A literature review. *Computers & Education*, *149*, 103818.

Wang, R. Y., & Strong, D. M. (1996). Beyond accuracy: What data quality means to data consumers. *Journal of management information systems*, *12*(4), 5-33.

Wang, S., & Noe, R. A. (2010). Knowledge-sharing: a review and directions for future research. *Human Resource Management Review* 20(2), 115–131.

Wiafe, I., Koranteng, F. N., Owusu, E., Ekpezu, A. O., & Gyamfi, S. A. (2020). Persuasive social features that promote knowledge sharing among tertiary students on social networking sites: An empirical study. *Journal of Computer Assisted Learning*, *36*(5), 636-645.

Whitton, N., & Langan, M. (2018). Fun and games in higher education: an analysis of UK student perspectives. *Teaching in Higher Education*, 1-14.

Wixom, B. H., & Todd, P. A. (2005). A theoretical integration of user satisfaction and technology acceptance. *Information Systems Research*, *16*(1), 85-102.

Wu, J., & Liu, D. (2007). The effects of trust and enjoyment on intention to play online games. *Journal of electronic commerce research*, *8*(2).

Wunderlich, P., Veit, D. J., & Sarker, S. (2019). Adoption of Sustainable Technologies: A Mixed-Methods Study of German Households. *MIS Quarterly*, *43*(2).

Xu, Y. (2011). Literature review on web application gamification and analytics. *Honolulu, HI*, 11-05.

Xu, F., Weber, J., & Buhalis, D. (2013). Gamification in tourism. In *Information and Communication Technologies in Tourism 2014* (pp. 525-537). Springer, Cham.

Yamani, H. A. (2021). A Conceptual Framework for Integrating Gamification in eLearning Systems Based on Instructional Design Model. *International Journal of Emerging Technologies in Learning*, *16*(4).

Yang, Y., Asaad, Y., & Dwivedi, Y. (2017). Examining the impact of gamification on intention of engagement and brand attitude in the marketing context. *Computers in Human Behaviour*, *73*, 459-469.

Yang, Q., & Gong, X. (2021). The engagement–addiction dilemma: an empirical evaluation of mobile user interface and mobile game affordance. *Internet Research*.

Yang, T. M., & Wu, Y. J. (2014). Exploring the determinants of cross-boundary information sharing in the public sector: An e-Government case study in Taiwan. *Journal of Information Science*, *40*(5), 649-668.

Zainuddin, Z., Chu, S. K. W., Shujahat, M., & Perera, C. J. (2020). The impact of gamification on learning and instruction: A systematic review of empirical evidence. *Educational Research Review*, *30*, 100326.

Zhang, X., Meng, Y., de Pablos, P. O., & Sun, Y. (2019). Learning analytics in collaborative learning supported by Slack: From the perspective of engagement. *Computers in Human Behaviour*, *92*, 625-633.

Zichermann, G., & Cunningham, C. (2011) *Gamification by design: Implementing game mechanics in Web and mobile apps*. Sebastopol, CA: O'Reilly Media.

APPENDICES

Appendix I: Analysis of Literature Review on Gamification

Table 1. Dominant Conceptual Approaches – Research Frameworks in Gamification Research

Research Framework	Number of papers	Percent
No theory	17	16.81%
Gamified theory of learning	4	3.96%
Self-determination theory	7	6.93%
Gamifying process framework	4	3.96%
Conceptual	11	10.89%
ARCS motivational model	5	4.95%
ARCS+G model	4	3.96%
MAKE (motivation, attitude, knowledge, and engagement) framework	4	3.96%
Activity theory	4	3.96%
Model of GM	4	3.96%
Flow theory	4	3.96%
Treasure Hunt model	4	3.96%
Solo Taxonomy model	4	3.96%
intelligent Moodle (iMoodle)	4	3.96%
Gamification model (canvas)	2	3%
MDA framework	5	4.95%
MDE framework (mechanics, dynamics emotions	4	3.96%
Bloom Taxonomy model	4	3.96%
The user role model	4	3.96%
Cognitive evaluation theory	2	3%
Total	*101*	*100%*

Table 2. Dominant Issues in Gamification Research in Developing Economies

Themes	Sub-themes	Game Design Elements	No. of papers	Percent
Affordances	Progress Affordances	Points, score	14	25%
		Leaderboard, levels	15	27%
		Quizzes, timer	7	12%
		Badges, trophies	11	20%
		Progress bars, achievements, status bars	9	16%
	Social Affordances	Teams	15	27%
		Competition	20	36%
		Social networking	14	25%
		Assistance	7	12%
		Narratives, storyline	31	55%
	Immersion Affordances	Avatars (visual representations of players within games)	15	27%
		Virtual world	10	18%
Outcomes	Psychological Outcomes	Attitude towards gamification use: e.g. Use experience, perception of gamification in education and learning, perception of organisational or classroom learning, satisfaction, subject to change	17	30%
		Challenges experience: e.g., Extra curriculum work, constant online frustration, perceived difficulty, perceived ease of use, lack of training and know-how, cost of staying online, disengagement, anxiety, the functionality of application	8	15%
		Affective/Social/Cognitive: e.g. Fun, immersion, flow experience, enjoyment, experience of emotions, perceived social interaction, social comparison, social influence, familiarity, motivation, perception of learning, involvement, perceived competition	31	55%
		Engagement: e.g., System use, continuous use – complete task, quiz attendance, participation in discussions and the system, downloading and viewing course materials, physical activity	29	52%
	Behavioural Outcomes	Performance: e.g., Position on leaderboards, learning, skills acquisition and progression, tracking points and badges, speed of completion, time, timely feedback and points, number of attempts to completion, course and exam grade, academic performance, stress release, physical activity	21	38%
		Social interaction: e.g., Social influence, cooperation, relatedness, number of colleagues, request for help to complete the task	6	10%

Table 3. Dominant Domains in Gamification Research in Developing Economies

Domain	Forms of domain	Number of papers	Percent
Education	e-Learning applications, distance education, learner's personality, programming language	37	36.63%
Design and development of gamification	Medical education (e.g., Leptospirosis), exercise, stress management, sexual health education, family health app	23	22.77%
Business	Banking, consumer behaviour and marketing strategies,	17	16.83%
	enterprise systems, management		
Transportation	Driving lessons	3	2.97%
Corporate Training	Training industry players and employees/ recruitment	5	4.95%
Agriculture	Farming lessons, innovation, e-Agriculture	5	4.95%
Social networking	Sharing, information gathering, public education	4	5%
Energy conservation behaviour	Efficient electricity use, cost-effective, prevention strategies	3	2.97%
Nutrition	Knowledge of unhealthy eating – high salt, sugar, and saturated fat	4	4.95%
Total		101	100%

Table 4. Methodological Approaches to the Study of Gamification

Methodological approaches	Number of papers	Percent
Quantitative	37	66%
Descriptive	*(19)*	*(51%)*
Modelling	*(11)*	*(31%)*
Comparison and association-based	*(7)*	*(19%)*
Qualitative	7	12.5%
Design science	7	12.5%
Mixed method	5	9%
Total	*56*	*100%*

Appendix A: Psychometric Measures and Cross Loadings

Psychometric measures for motivation-opportunity-ability perspective

Construct	Dimensions	Items	Source	Measures	Loading /Weight
Information Technology capability (ITC)	Technical capability	IT1: students are skilled to use IT tools	Panda & Rath, 2021; Lee et al., 1995; Fink & Neumann, 2007	Reflective	0.812*
		IT2: students' skills level in distributed computing			
		IT3: students' skills level in developing web-based applications			
	Behavioural capability	IT1: self-directed and proactive use of IS	Lee et al., 1995; Fink & Neumann, 2007	Reflective	0.851*
		IT2: the ability to plan, organise and lead tasks in an IS			
		IT3: execute work in a collective IS environment			
	Educational capability	IT1: knowledge about educational functions	New measures based on Lee et al., 1995; Fink & Neumann, 2007	Reflective	0.912*
		IT2: encouragement in learning new information technologies			
		IT3: follow trends in information technologies			
Information Quality (IQ)	Completeness	IT1: complete set of information	Wixom & Todd (2005)	Reflective	0.852*
		IT2: comprehensive information			
		IT3: provides the required information.			
	Format	IT1: well-formatted		Reflective	0.791*
		IT2: well laid out			
		IT3: clearly presented/ concisely			
	Accuracy	IT1: correct information		Reflective	0.782*
		IT2: few errors			
		IT3: accurate information			
	Currency	IT1: most recent source of information		Reflective	0.871*
		IT2: most current information			
		IT3: sufficient and always up to date			
Continuance Use of Aesthetic Experience (AE)	Rewards	IT1: offering points to learning activities	New measures based on Kankanhalli et al. (2012)	Formative	0.815**
		IT2: accumulation of points gained			
		IT3: offers more points as effort increases			
	Competition	IT1: compete with mates	New measures based on Lee & Yang (2011)	Formative	0.793**
		IT2: compare the performance			
	Self-expansion	IT1: increased ability to accomplish new learning	Adapted from Mattingly & Lewandowski	Formative	0.917**
		IT2: results in learning new things			
		IT3: larger earning perspective			

			(2013); Suh et al. (2017)		
	Meaning	IT1: feel learning activities are important	Adapted from Suh, Cheung, Ahuja & Wagner (2017)	Formative	0.941**
		IT3: feel learning activities are personally meaningful			
		IT3: the feeling of meaningful interaction			
Continuance use – CU (intention to continue using the gamified IS)	CU1	IT1: on a regular basis	Adapted from Bhattacherjee & Premkumar, (2004); Deng et al. (2010)	Reflective	0.932*
	CU2	IT2: frequently in future use			0.911*
	CU3	IT3: daily life activities			0.872*

**: indicate the weight of the item *: indicate loading of the item

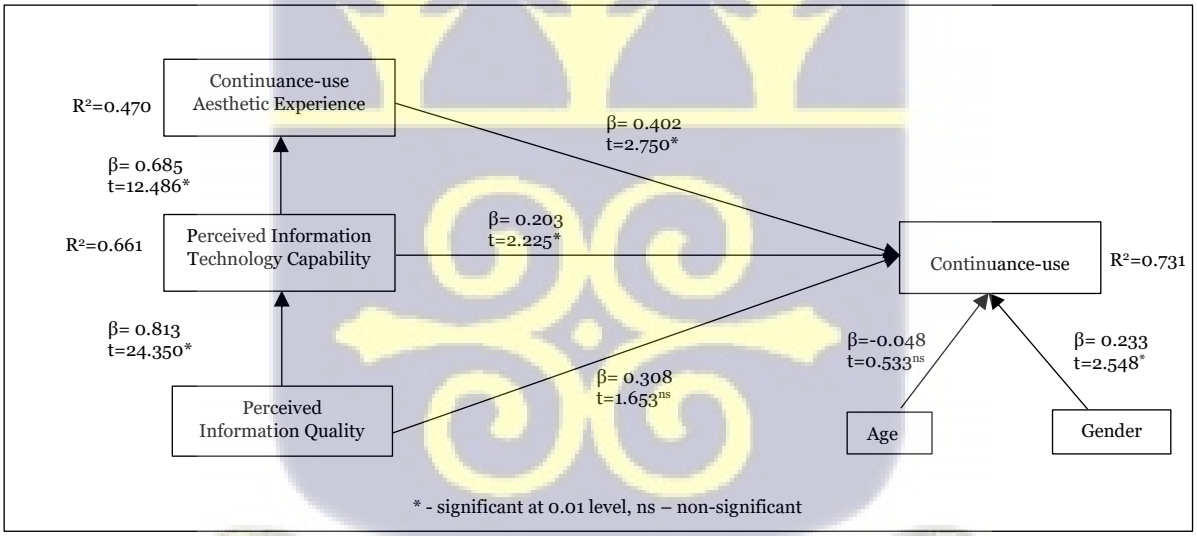
Appendix A1 Cross loadings and indicator reliability

ITEMS	CMP	REW	AUT	CPT	RLD	MOT	ENG	α
CMP1: The gamified application allows me to compete with others.	0.75	0.32	0.36	0.21	0.16	0.28	0.33	**0.806**
CMP2: The gamified application allows me to compare my performance to that of others.	0.79	0.38	0.33	0.29	0.23	0.30	0.34	
CMP3: The gamified application allows me to threaten the status of others by my active participation.	0.70	0.27	0.14	0.46	0.19	0.11	0.40	
CMP4: There is a high degree of competition for rewards on the gamified platform.	0.84	0.28	0.31	0.51	0.12	0.09	0.23	
REW1: The gamified application allows me to obtain points as a reward for my activities.	0.17	0.84	0.35	0.52	0.06	0.03	0.21	**0.855**
REW2: Gamification allows me to accumulate points that I have gained.	0.21	0.91	0.30	0.49	0.19	0.21	0.53	
REW3: The gamified application allows me the possibility to obtain more points if I try harder.	0.19	0.83	0.19	0.39	0.31	0.32	0.50	
REW4: Learning with the gamified application gives me a sense of personal accomplishment or achievement.	0.18	0.76	0.33	0.56	0.28	0.22	0.33	
AUT1: I can decide which activities I want to practice on MLearn (e.g. midwifery care, research methods)	0.26	0.13	0.81	0.39	0.02	0.19	0.27	**0.801**
AUT2: I can decide what skills I want to practice on the gamified application.	0.160	0.16	0.80	0.42	0.15	0.23	0.06	
AUT3: I feel that I use the gamified application because I want to.	0.10	0.21	0.75	0.49	-0.22	0.09	-0.31	
CPT1: I think I am pretty good at gamification	0.26	0.35	0.18	0.71	0.29	0.50	-0.06	**0.742**
CPT2: I am satisfied with my performance on gamified application	0.22	0.42	0.26	0.76	0.41	0.14	0.20	
CPT3: After using the application for a while now, I feel pretty competent.	0.34	0.45	0.30	0.81	0.30	0.03	0.16	
RLD1: RLD1: With the other students on the gamified platform, I feel a sense of	033	0.36	0.19	0.19	0.92	0.00	0.31	**0.895**

contact with people who care for me and whom I care for.								
RLD2: With the other students on the gamified platform, I feel close and connected to other people who are important to me.	0.25	0.31	0.09	0.26	0.92	-0.04	0.33	
RLD3: With the other students on the gamified platform, I feel a strong sense of intimacy with	0.30	0.26	0.18	0.09	0.88	-0.21	0.10	
CS1: I take part in this gamified platform because it is fun learning course materials on gamified applications.	0.21	0.31	0.06	0.26	0.26	0.88	0.12	**0.863**
CS2: I take part in this gamified platform because I enjoy learning new courses and skills.	0.24	0.25	0.09	0.29	0.23	0.89	0.11	
CS3: I take part in this gamified platform because gamification is exciting	0.16	0.27	0.23	0.31	0.14	0.88	0.27	
ENG1: I find my studies to be full of meaning and purpose with gamification	0.15	0.22	0.36	0.08	0.10	0.05	0.91	**0.901**
ENG2: I feel happy when I am studying intensively with gamification	0.27	0.16	0.33	0.18	0.13	0.15	0.93	
ENG3: I can continue for a very long time when studying with gamification	0.09	0.41	0.41	0.26	0.18	0.09	0.89	

Note CMP – Competition, REW – Rewards, AUT – Autonomy, CPT – Competence, RLD – Relatedness, CS – Course Satisfaction, ENG – Engagement, α – Cronbach alpha

Figure 6.1 Result of Structural Analysis for Objective 2



Appendix A2 Loadings and cross-loadings

	ITCt	ITCb	ITCe	IQc	IQf	IQa	IQcu	Reward	Compet	Self - ex	Meaning	CU
ITCt1	0.793	0.102	0.275	0.313	0.224	0.266	0.366	0.285	0.312	0.233	0.294	0.355
ITCt2	0.878	0.034	0.292	0.373	0.220	0.268	0.341	0.294	0.343	0.228	0.300	0.397
ITCt3	0.756	0.121	0.267	0.313	0.230	0.278	0.454	0.276	0.306	0.227	0.299	0.198
ITCb1	0.443	0.876	0.243	0.312	0.244	0.267	0.381	0.298	0.302	0.239	0.298	0.361
ITCb2	0.458	0.862	0.238	0.352	0.222	0.294	0.380	0.302	0.353	0.220	0.316	0.365
ITCb3	0.479	0.843	0.264	0.321	0.238	0.270	0.441	0.292	0.317	0.247	0.289	0.299

ITCe1	0.412	0.024	0.783	0.316	0.230	0.279	0.378	0.308	0.205	0.229	0.298	0.362
ITCe2	0.441	0.120	0.850	0.319	0.230	0.278	0.371	0.314	0.223	0.237	0.290	0.372
ITCe3	0.407	0.330	0.815	0.311	0.225	0.286	0.358	0.300	0.222	0.235	0.296	0.175
IQc1	0.383	0.344	0.266	0.821	0.232	0.269	0.353	0.285	0.297	0.240	0.288	0.167
IQc2	0.448	0.222	0.245	0.831	0.246	0.281	0.385	0.293	0.220	0.245	0.300	0.170
IQc3	0.380	0.218	0.270	0.860	0.235	0.264	0.350	0.289	0.287	0.250	0.296	0.186
IQf1	0.425	0.330	0.252	0.304	0.835	0.280	0.384	0.278	0.317	0.241	0.303	0.138
IQf2	0.404	0.130	0.256	0.305	0.844	0.279	0.424	0.284	0.329	0.249	0.294	0.106
IQf3	0.415	0.125	0.262	0.303	0.802	0.270	0.380	0.280	0.310	0.237	0.282	0.000
IQa1	0.411	0.132	0.258	0.304	0.231	0.845	0.476	0.294	0.316	0.240	0.279	0.059
IQa2	0.112	0.246	0.255	0.308	0.237	0.826	0.380	0.296	0.315	0.239	0.295	0.367
IQa3	0.399	0.024	0.262	0.323	0.215	0.828	0.338	0.305	0.321	0.232	0.303	0.390
IQcu1	0.149	0.020	0.252	0.123	0.237	0.274	0.835	0.296	0.301	0.224	0.295	0.038
IQcu2	0.154	0.030	0.269	0.116	0.233	0.269	0.841	0.281	0.309	0.231	0.294	0.100
IQcu3	0.119	0.044	0.263	0.199	0.231	0.273	0.839	0.290	0.297	0.237	0.282	0.313
Rewd1	0.106	0.022	0.253	0.103	0.236	0.282	0.365	0.911	0.303	0.241	0.294	0.361
Rewd2	0.226	0.138	0.232	0.021	0.233	0.294	0.397	0.896	0.320	0.221	0.305	0.341
Rewd3	0.390	0.130	0.258	0.027	0.216	0.297	0.370	0.794	0.344	0.232	0.296	0.371
Compet1	0.310	0.210	0.270	0.020	0.225	0.268	0.381	0.291	0.8315	0.226	0.278	0.352
Compet2	0.451	0.215	0.255	0.327	0.228	0.276	0.371	0.292	0.804	0.232	0.300	0.354
Selfex1	0.420	0.332	0.255	0.309	0.227	0.285	0.384	0.289	0.319	0.823	0.303	0.348
Selfex2	0.451	0.346	0.268	0.304	0.223	0.280	0.417	0.291	0.330	0.724	0.288	0.291
Selfex3	0.405	0.300	0.274	0.305	0.230	0.271	0.373	0.281	0.320	0.771	0.297	0.351
Mean1	0.397	0.141	0.264	0.420	0.229	0.270	0.370	0.305	0.316	0.229	0.881	0.381
Mean2	0.008	0.122	0.263	0.324	0.218	0.280	0.374	0.285	0.307	0.217	0.830	0.337
Mean3	0.019	0.211	0.232	0.311	0.239	0.081	0.330	0.302	0.310	0.235	0.791	0.402
CU1	0.150	0.341	0.259	0.312	0.226	0.181	0.412	0.283	0.311	0.229	0.295	0.918
CU2	0.118	0.338	0.246	0.331	0.218	0.190	0.366	0.302	0.316	0.213	0.307	0.936
CU3	0.268	0.413	0.261	0.324	0.222	0.84	0.332	0.287	0.335	0.232	0.310	0.941

Notes: ITCt – ITC technical capability; ITCb – ITC behavioural capability; ITCe – ITC educational capability; IQc – IQ completeness; IQf – IQ format; IQa – IQ accuracy; IQcu – IQ currency; Rewd – reward; Compet – competition; Selfex – self-expansion; Mean – meaning; CU – continuance use.

Appendix B: Gamification Survey Instruments

(Questionnaire One for answering research question 1)

Appendix B1

Construct and measurement items	1	2	3	4	5	6	7
Performance Expectancy							
PE1: Gamification would improve my academic performance							
PE2: Gamification would allow me to do more work in less time							
PE3: Gamification would make it easier to do my school work							
PE4: Gamification would encourage interactive learning with my colleagues							
PE5: Gamification would motivate and encourage learning							
Effort Expectancy							

EE1: Learning to use a gamified system would be easy for me							
EE2: Using a gamified system will be easy and without much help							
EE3: It would be easy for me to become skilful at using gamification							
EE4: I would find gamification easy to use because of my game skills and use of LMS							
Social Influence							
SI: My friends will like it if I choose to learn with games							
SI2: Friends use games to learn							
Attitude							
AT1: I think gamification is a good idea for students							
AT2: I think gamification is a good idea for the university							
AT3: I am interested in using computer games in learning							
Facilitating Conditions							
FC1: My familiarity with LMS and playing games would equip me in using other added features such as gamification							
FC2: There is a specific person or unit available for assistance with any technical problem I may encounter							
Image							
IM1: I think that people who use gamification in learning are getting a better education							
IM2: I think that people who use gamification have bragging rights and social capital as they achieve a high score							
Trust							
TR1: The UNI-GAMI internet is trustworthy for gamification services in LMS							
TR2: The UNI-GAMI ICT can be trusted to carry out gamification in LMS							
Behavioural Intention							
BI1: I intend to use gamification in the future							
BI2: I plan to use gamification in the future							

Questionnaire Two

(Questionnaire Two for answering research question 2)

Appendix B2

Constructs and measurement items	1	2	3	4	5	6	7
Competition - CMP1: The gamified application allows me to compete with others.							
CMP2: The gamified application allows me to compare my performance to that of others.							
CMP3: The gamified application allows me to threaten the status of others by my active participation.							
CMP4: There is a high degree of competition for rewards on the gamified platform.							
Reward - REW1: The gamified application allows me to obtain points as a reward for my activities.							
REW2: Gamification allows me to accumulate points that I have gained.							
REW3: The gamified application allows me the possibility to obtain more points if I try harder							
REW4: Learning with the gamified application gives me a sense of personal accomplishment or achievement							
Autonomy - AUT1: I can decide which activities I want to practice on gamified applications (e.g. midwifery care, research methods							

AUT2: I can decide what skills I want to practice on the gamified application.							
AUT3: I feel that I use the gamified application because I want to.							
Competence - CPT1: I think I am pretty good at application							
CPT2: I am satisfied with my performance on the gamified application							
CPT3: After using the application for a while now, I feel pretty competent.							
Relatedness - RLD1: With the other students on the gamified platform, I feel a sense of contact with people who care for me and whom I care for.							
RLD2: With the other students on the gamified platform, I feel close and connected to other people who are important to me.							
RLD3: With the other students on the gamified platform, I feel a strong sense of intimacy with the colleagues I spent time with							
Course Satisfaction - CS1: I take part in this gamified platform because it is fun learning course materials on gamified applications.							
CS2: I take part in this gamified platform because I enjoy learning new courses and skills.							
CS3: I take part in this gamified platform because gamification is exciting for learning							
Learning Engagement - ENG1: I find my studies to be full of meaning and purpose with gamification							
ENG2: I feel happy when I am studying intensively with gamification							
ENG3: I can continue studying for a very long time using the gamified application							

Questionnaire Three

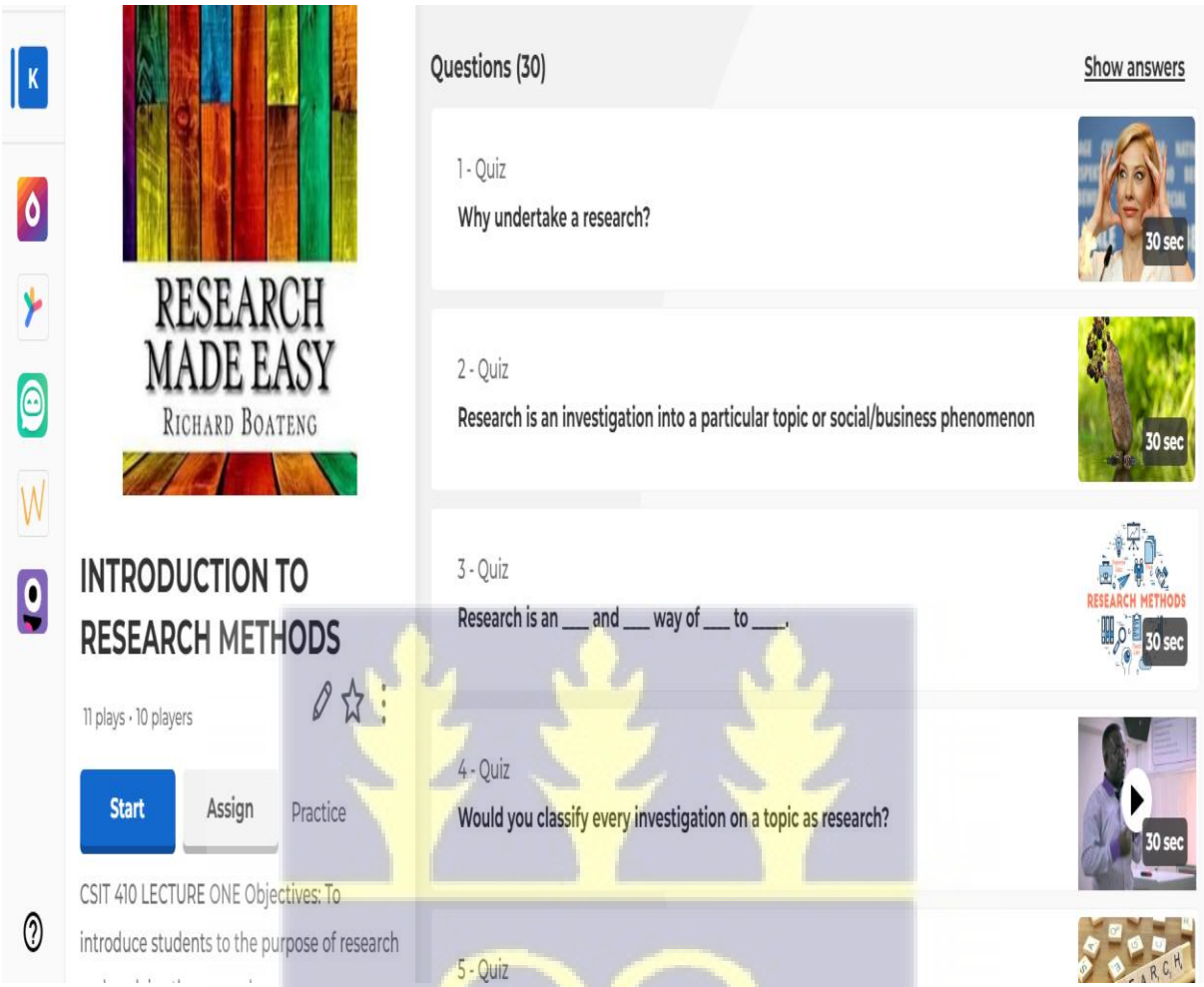
(Questionnaire Three for answering research question 3)

Appendix B3

Constructs and measurement items	1	2	3	4	5	6	7
Perceived information technology capability (ITC)							
Technical capability (α=0.801, CR=0.881, AVE=0.713)							
I am skilled in using gamification and IT learning tools							
I am skilled in distributed computing in education and have achieved most goals							
I am skilled in developing web-based applications for learning and obtain important outcomes							
Behavioural capability							
I am self-directed and proactive to use the IS							
I can plan, organise and lead assignments on the IS							
I can plan and execute work in a collective IS environment							
Educational capability							
The IT students are knowledgeable about educational IT functions and overcome many challenges successfully with IT							
The IT students are encouraged to learn new information technologies							
The IT students closely follow the trends in current information technologies							
Perceived information quality (IQ)							
Completeness (α=0.89, CR=0.790, AVE=0.558)							
The gamified IS provides me with a complete set of information							
The gamified IS provides comprehensive information							
The gamified IS provides me with the information I need							
Format							

The information provided by the gamified IS is well-formatted							
The information provided by the gamified IS is well laid out							
The information provided by the gamified IS is clearly presented and concisely							
Accuracy							
The gamified IS produces correct information							
There are few errors in the information I obtained from the gamified IS							
The information provided by the gamified IS is accurate							
Currency							
The gamified IS provides me with the most recent source of information							
The gamified IS produces the most current information for our studies							
The information from the gamified IS is sufficient and always up to date							
Continuance-use aesthetic experience (AE)							
Rewards (α=0.95, CR=0.897, AVE=0.744)							
The gamified IS offers me points as a reward for my activities							
The gamified IS accumulate points I have gained							
The gamified IS offers me more points when I try harder							
Competition							
The gamified IS makes me compete with my colleagues							
The gamified IS makes it possible to compare performance with colleagues							
Self-expansion							
Using the gamified IS feels an increased ability to accomplish new learning ideas							
I feel my activities result in learning new things when using the gamified IS							
I feel that I have a more significant learning perspective of what I am doing when using the gamified IS							
Meaning							
I feel my learning activities are very important to me when using the gamified IS							
I feel my learning activities are personally meaningful							
I feel I have a meaningful interaction with the gamified IS							
Continuance-use							
Due to the prompt feedback, I intend to continue using the gamified IS rather than discontinue regularly							
I intend to continue using the gamified IS frequently in future to enhance learning interaction with the system and the instructor							
I intend to use the gamified IS in my daily life activities							

Appendix B3a. Sample of a Gamified Course



Forms of Game Design Elements

Appendix B4

Post-Study Questionnaire – Interview with Lecturers *(15 September 2021)*

Researcher: Thank you for taking the time to talk to me about gamification as a strategy for effective teaching and learning in Higher Education. Have you personally used the Kahoot or gamification system before? How long? What was your experience using it?

Lecturer: Yes. I have been using gamification systems like Kahoot and Blackboard in various courses for five years now to engage students prior to the actual discussions. My experience in Kahoot, in particular, is very rewarding as I see my students being motivated to participate. The beauty of the system even enhances learning, in addition to the ease of use.

I hope you remember the name the students called me the last time you came for data from them..."The Kahoot Man." The level of engagement and motivation the systems provide for students' learning is phenomenal.

Researcher: What did you like or dislike about the kahoot system?

Lecturer: What I like the most about the Kahoot system is that it is free, which is not very common with educational applications. So far, I don't remember anything that is dislikeable. Sometimes when they use it during a class session, you see much motivation in learning. The feedback is immediate for prompt learning response.

Importantly, learning online improved the IT competencies and prepare them for the new normal of virtual work.

Researcher: Would you still like the kahoot system if it did not have the gaming elements? Any reason

Lecturer: Yes. I believe the gaming elements are simply a layer of what Kahoot is all about, offering a quiz-like competition. I'm more interested in the competition it initiates between students.

Researcher: What courses or subjects were you teaching the students on Kahoot? Moreover, what were the levels of study?

Lecturer: Computer Programming and Nursing (Undergraduate)

Researcher: Can you give me a background as to why you adopted Kahoot for your students?

Lecturer: Computer programming is a difficult course, especially for beginners. I needed a way to make the subject fun and relatable even though it is perceived as a boring subject. Also, as lecturers we look inward to find teaching solutions for improvement, and we look outward to understand the innovation and new opportunities technologies bring. This led to identifying gamification and other tutoring systems.

Researcher: How are your students experience using the kahoot system for teaching and learning?

Lecturer: As far as my observation goes, they were all engaged in participating in the game. The problem is afterwards.

Researcher: Can you say it improved their learning performance? Any example to give<

Lecturer: The learning performance requires further analysis, but I witnessed a high engagement with the Kahoot system. Students mostly engaged in it at odd times and throughout the whole week and course activities. Without much analysis, the current crop of students'

performance is better than the previous year since they all scored above average. The previous year group didn't use Kahoot due to the time factor.

Researcher: Was the kahoot used for the whole semester?

Lecturer: No. In some topics only.

Researcher: How is using the kahoot system different to being taught in a classroom (by a lecturer)?

Lecturer: It is very different such that the students feel at ease to pose questions in their free time. Also, the liberty to learn at odd times and engage in discussions with their colleagues and me. Further, for the face-to-face, if a student misses a class, that is all for the session but the kahoot and other learning systems, the recorded videos are preserved for absentees. Students can play the video as countless as they want till they understand the course of study. Notwithstanding, Kahoot cannot replace lecturers because nothing replaces social and humanistic teaching experience. Emotions are hidden in online education.

Researcher: How helpful was Kahoot during the Covid-19? Any experience to share?

Lecturer: It is very helpful, especially when it is difficult to connect with students online. The kahoot was a good choice since the students were already using it before the Covid-19 pandemic erupted.

Researcher: Based on your teaching experience at the higher education level, has the Covid-19 pandemic and the new normal adopted by universities in Ghana impacted students learning engagement

Lecturer: Yes, it has impacted most of our educational outcomes. For example, when we migrated to online education, the students were very engaging and almost 90% of them were online to learn. However, three weeks into teaching, I started recording huge dropouts most times 30% of the students were present. So, I even recommended to my HOD the need for blended learning else the students won't benefit much. However, they have their means of passing the exams.

**Most students accessed the system via their mobile phones and laptops, but almost all preferred the laptop during quizzes.*

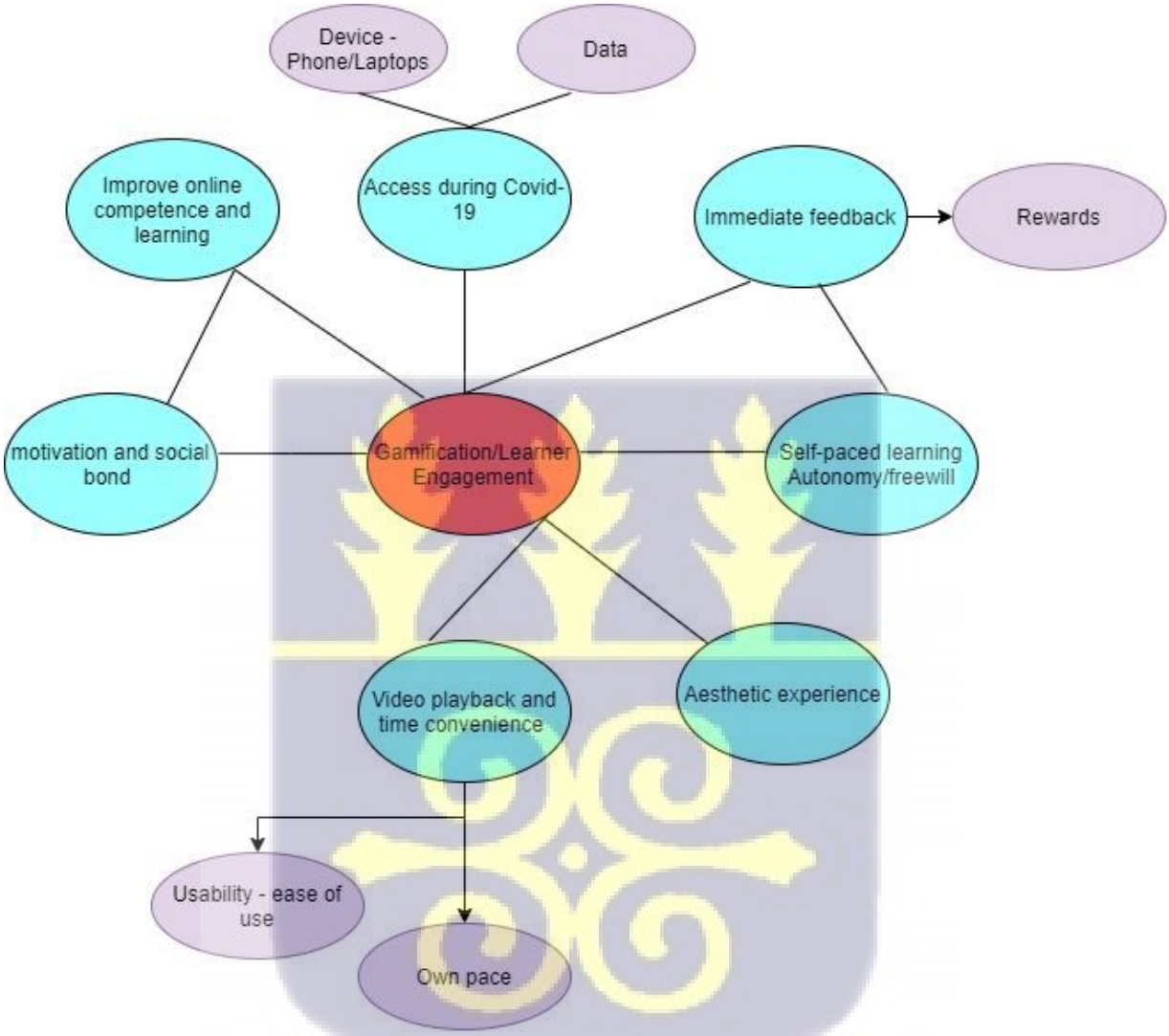
Researcher: Thank you for your time

Lecturer: You are welcome

Appendix B3A: Themes Resulting from Lecturers' Interview

The interview with the lecturers revealed some common themes worth summarising. The themes are specific to students of UNI-GAMI. Among the themes gathered, engagement and motivation were occasionally mentioned as the reason for adopting the gamified system.

Figure B3A: Summary of Thematic Codes



The main findings from the interview with the lecturers indicate that aesthetic experience, immediate feedback, accessibility, motivation, online competence, self-paced learning and the convenience of using the gamification system were important factors to consider when investigating the acceptance and engagement of gamified learning systems in developing economies. Notwithstanding the importance of gamified information systems, the lecturers revealed that it could not replace the traditional teaching methods. Hence, I recommend a blended learning approach, especially in post Covid-19 pandemic era.

Appendix C – My Peer-Reviewed Publications and Recognition from this Thesis

Journal Papers

1. **Ofosu-Ampong, K**., Boateng, R., Kolog, A. E., & Anning-Dorson, T. (2021). Motivation in Gamified Social Media Learning: A Psychological Need Perspective. *Journal of Information Systems Education (JISE).* 32 (3), 199-212 *(Published in JISE Special Issue on Social Media: Computing Education Perspective in Diverse Educational Contexts). Research Objective 2.*

2. **Ofosu-Ampong, K.,** Boateng, R., Anning-Dorson, T., & Kolog, E. A. (2020). Are we ready for Gamification? An exploratory analysis in a developing economy. *Education and Information Technologies*, *25*(3), 1723-1742. *Research Objective 1.*

3. **Ofosu-Ampong, K.** (2020). The Shift to Gamification in Education: A Review on Dominant Issues. *Journal of Educational Technology Systems*, *49*(1), 113-137.

Book Chapter

4. **Ofosu-Ampong, K.,** & Anning-Dorson, T. (2020) Gamification Research: Preliminary Insights into Dominant Issues, Theories, Domains, and Methodologies. Book Chapter in *Handbook of Research on Managing Information Systems in Developing Economies* (pp. 397-412); also included in *Handbook of Research Anthology on Game Design, Development, Usage, and Social Impact* (10.4018/978-1-6684-7589-8.ch089) pp. 1836-1851. IGI Global.

Full Conference Papers

5. **Ofosu-Ampong, K** & Boateng, R. (2020). Motivation and Information Affordances Towards User Engagement in a Gamified System. In *Proceedings of the Southern Association for Information Systems Conference* (SAIS), Myrtle Beach, SC, USA.

6. **Ofosu-Ampong, K.,** Boateng, R., Kolog, A. E., & Anning-Dorson, T. (2020). Examining Information Quality and Perceived Learning Performance in a Gamified Environment. In *Proceedings 22nd IEEE International Conference on Business Informatics*. IEEE. DOI: 10.1109/CBI49978.2020.10052

7. **Ofosu-Ampong, K.,** & Boateng, R. (2018). Gamifying Sakai: Understanding Game Elements for Learning. In *Twenty Fourth American Conference on Information Systems* (pp. 1–10). New Orleans, LA: Association for Information Systems Electronic Library. AMCIS 2018 -ISBN: 978-0-9966831-6-6.

Global Recognition

8. **President/Vice President/Secretary –** The Association for Information Systems Special Interest Group for Game Design and Research (AIS SIGGAME) *December 2019 to date (four-year term) (the first PhD Researcher to be appointed from an African university).* https://communities.aisnet.org/siggame/new-item5/new-item4

UNIVERSITY OF GHANA

ETHICS COMMITTEE FOR THE HUMANITIES (ECH)

P. O. Box LG 74, Legon, Accra, Ghana

My Ref. No…ECH 046/ 20-21 …

October 30, 2020

Kingsley Ofosu-Ampong
Department of Operations and MIS
University of Ghana
Legon

ETHICAL CLEARANCE
(ECH 046/ 20-21)

The protocol tittle below has been reviewed and approved by the ECH Committee.

TITLE OF PROTOCOL**: ADOPTION, USER ENGAGEMENT AND CONTINUANCE USE OF GAMIFIED INFORMATION SYSTEMS IN HIGHER EDUCATION**

PRINCIPAL INVESTIGATOR**: KINGSLEY OFOSU-AMPONG**

Please note that the final review report must be submitted to the Committee at the completion of the study. Your research records may be audited at any time during or after the implementation. Any modification of this research project must be submitted to ECH for review and approval prior to implementation.

Please report all serious adverse events related to this study to ECH within seven (7) days verbally and in writing within fourteen (14) days.

This certificate is valid till October 29, 2021. You are to submit annual reports for continuing review.

Please accept my congratulations.

Yours Sincerely,

Professor C. Charles Mate-Kole
ECH Chair

Cc: Prof. Richard Boateng, Department of Operations and MIS, UG

Tel: +233-303933866 Email: ech@ug.edu.gh

Appendix E: Recognition from Association for Information Systems (AIS) for contributing to Gamification and Game Design Research Community