Chapter 5
Gamification of E-Learning in African Universities:
Identifying Adoption Factors Through Task-Technology Fit and Technology Acceptance Model

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ABSTRACT

Gamification in education is a strategy of motivating and engaging students by integrating game design features into the instructional process. Although there is a growing body of scientific evidence supporting the effectiveness of gamification in the educational setting, some of the evidence is inconclusive and insufficient, especially in developing nations. The purpose of this study is to integrate the technology acceptance model and task technology fit to investigate instructors' intention to use gamified online learning. A sample of 50 participants across various African institutions was involved in this study. Structural equation modelling implemented via partial least squares (PLS) is used to test the research hypotheses. The results revealed that intention to use gamified online learning was significantly and positively influenced by task technology fit, perceived usefulness, and attitude. Notably, subjective norms, facilitating conditions, and computer anxiety failed to predict behavioural intention. The authors discuss the implications of the findings and propose future directions.

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INTRODUCTION

Described as a strategic attempt to enhance organisations, systems, and services, gamification harnesses game elements and utilises them in a non-game context. (Deterding et al., 2011). Albeit there is no extensive list of game elements, the most commonly utilised ones are points, badges, levels, leaderboards, challenges, and badges (Manzano-Leon et al., 2021; Deterding et al., 2011; Mustafa et al., in press). Applying these game elements in the classroom aims makes learning more appealing while inspiring young learners in the modern age of interactivity and games (Glover, 2013). In its most basic form, gamified learning approaches enhance an existing learning system and transform it into a game-like experience. The strength of interactive gamified learning lies in its potential to influence behaviour towards an intended goal.

Most significantly, in the Coronavirus pandemic (COVID-19) age, gamifying online learning platforms can offer students a degree of commitment to compensate for the lack of classroom activities. This becomes more important, especially that many institutions have implemented blended learning or exclusively online instruction to avoid disruptions in student learning. Nevertheless, in addition to coping with unexpected technical issues, instructors face challenges adapting their lessons to the online environment effectively. A principal challenge with the present online learning systems for educators is encouraging and motivating students to use the system effectively (Cable & Cheung, 2017).

Accordingly, gamification has gained prominence in the education context and is actively being explored (Rodrigues et al., 2021; de la Pena et al., 2021). Several scholars argue that when gamification is designed and implemented appropriately, it can improve students' learning performance through a behavioural change (Sailer & Homner, 2020; Aldemir et al., 2018; Adukaite et al., 2017).

Furthermore, using game elements in online learning can significantly improve educational environments (Antonaci et al., 2019; Alabbasi, 2018). In the case of African universities, however, many are still not ready to gamify their educational programs and, failed to completely leverage the market opportunities of the digital gaming industry (Sawahel, 2020; Ofosu-Ampong et al., 2020). Nevertheless, the World Economic Forum reported that providing adequate education and employment to sub-Saharan citizens will attract an additional USD 500 billion to the region's economy over 30 years (Myers, 2016). Literature also shows that gamifying a university course can improve students' engagement and academic achievement (Manzano-Leon et al., 2021), critical to achieving a high-quality education. A recent study found that teachers have a favourable attitude toward gamification (Martí-Parreño et al., 2016; Sánchez-Mena & Martí-Parreño, 2016). Hence, gamification strategy in learning can motivate students, engage them in the learning process, and minimise dropout rates.

Despite the many potentials of gamification when integrated into online learning, only a limited number of African universities in Kenya, Nigeria, and South Africa currently utilise gamified learning environments (Sawahel, 2020; Ofosu-Ampong et al., 2020). Accordingly, African nations are yet to fully explore the potential of gamification in an online learning platform and its positive impact on students' engagement and performances. In this regard, it becomes crucial to understand factors that will affect the adoption of gamification-based online learning in various African institutions. Determining these factors will provide education leaders with the necessary knowledge to create strategies to encourage more adopters of such modern pedagogy. To make a robust model, and because only a few researchers have integrated information systems (IS) theory in investigating e-learning adoption, Technology Acceptance Model (TAM) was extended by utilising Task Technology Fit (TTF). The study findings

will offer practical and theoretical perspectives to improve awareness of the paradigm shift related to gamified online learning.

Preliminary Studies

Initially, to investigate the nature of TAM and TTF and their suitability in determining instructors' intention to adopt gamified learning approach in Africa, the researchers interviewed some respondents to share their experiences. Accordingly, most instructors identified the following reasons for using gamification:

- To expose students to the current motivational technological platforms for online learning
- To provide quick feedback on assignments, quizzes, and discussions
- To motivate learning and improve engagement and communication with and among students
- To promote excitement and fun in teaching and learning

The use of gamification has been centred on assignment creation and quizzes where students are to log in to the gamified system using their identification and attend to the questions. However, most institutions did not employ a generalised gamified system for instructors, implying that instructors relied on free gamification systems. Hence, popular open-source software such as Kahoot and blackboard were customised and used for teaching. However, these open-source gamified systems typically have limited functionality. As a result, the various institutional approaches toward adopting and using gamification in higher education institutions in Africa are still low (Ofosu-Ampong et al., 2020).

Notwithstanding, as previously mentioned, the COVID-19 pandemic also disrupted higher learning in Africa, encouraging more instructors, teachers, and students to embrace gamified online learning systems. Despite the potential benefits of gamification, the challenges faced by instructors in adopting it may account for its low penetration in Africa. These include lack of dedication and time to gamify a course for an academic year and possibly continue the lifecycle, lack of funding and programmers to take gamification agenda in universities (Ofosu-Ampong et al., 2020). Accordingly, this study seeks to identify the factors that are likely to influence instructors' use of gamified online learning systems in African universities.

The rest of this paper is organised as follows. The literature on gamified online learning, TAM, and TTF is reviewed in Section 2. The research model is presented in Section 3, while the research design and methodology in Section 4. The study findings are presented and discussed in Section 5. Section 6 concludes and summarises the study implications. Finally, Section 7 outlines study limitations and future studies.

LITERATURE REVIEW

For a tailored approach to understanding the objective of our study, we conduct a literature review on a selected area. First, we summarise the literature on the development of gamification that justifies the use of TAM and TTF in this area.

Gamification of Learning

Gamification in the past decade has become a widely discussed topic in education. Scholars have defined it in many ways, e.g., applying game design elements to a learning system for use in a non-game context (Deterding et al., 2011). In the learning context, gamification is referred to as gamified learning (Salier and Homner, 2019). In this sense, gamification enhances students' learning processes or activities towards the desired learning outcome. Well-known examples of gamified online learning systems are Coursera, Kahoot, and Udemy. As recent studies show, employing game features in online learning environments can lead to significant benefits. For example, badges positively influenced and improved student engagement (Ibanez et al., 2014), whereas leaderboards resulted in higher learning performance among engineering students (Ortiz-Rojas et al., 2019). In addition, students' attitudes and engagement were enhanced by using points, badges, and a scoreboard (Tan & Hew, 2016).

In the African context, gamification has been used to champion different activities. For instance, in a recent review on dominant gamification in Africa, the authors identified progress, social and immersion as prominent (Ofosu-Ampong & Anning-Dorson, 2020). These include points, trophies, narratives and stories, competition, and social networking. Hence, these affordances generate social learning, feedback, and self-learning experience with embedded videos. Moreover, since social learning is a critical component of gamification systems, researchers have proposed integrated models to advance the quality of learning via gamified forums by championing models that promote the personalisation of learning (Melzer, 2019).

Technology Acceptance Model

Davis (1986) proposed the TAM, which focuses on exploring mediating variables between system attributes and practical system implementation. The model suggests that two significant variables, perceived usefulness (PU) and perceived ease of use (PEOU), are instrumental in explaining the variance in users' intention. PU is the extent to which a person believes that using a particular system will enhance his or her job performance (Davis, 1989). On the other hand, PEOU is the extent to which a person believes that using a particular system will be free of effort (Davis, 1989). Among the beliefs, PEOU is hypothesised to be a predictor of perceived usefulness. TAM is the most influential theory in information systems and is used in several theoretical investigations (Wong et al., 2021; Huang et al., 2019; Wu & Chen, 2017).

Similarly, Lee (2014) stated that TAM is a well-accepted model in IS acceptance that explains consumer behaviour in the context of technology acceptance or rejection. However, researchers have noted that while TAM favours a significant relationship between attitude and adoption intention, this is not always the case (Wong et al., 2021; Shin & Kim, 2015). As such, other factors that inhibit people from adopting technology should be explored. This study considers task technology fit to be one of the most crucial factors influencing users' technology adoption, namely online learning systems.

Task Technology Fit

TTF is one of the most used theoretical models when assessing how information technology impacts performance, usage and evaluating the fit between task and technology characteristics. The fit between a task and technology can be affected by its task and technical. Consequently, this can determine the user's performance or utilisation of the system. TTF represents how a specific technology supports

one's effort to perform a task. Since its inception, TTF has been applied to various information systems (Gikas & Grant, 2013).

Additionally, TAM has been generally used to explain the acceptance of new technology in academic settings (Wu & Chen, 2017; Joo et al., 2016). Although studies have examined TTF in various contexts, there is limited research in gamified learning in African institutions to address social factors, limiting its ability to predict social relatedness and learning with technology. Currently, it is unclear whether a good task-technology fit influences a learner's adoption of gamification (Ofosu-Ampong et al., 2020). Accordingly, this study aims to provide a solid theoretical contribution to the acceptance of gamification and bridge the theoretical gap between TAM and TTF.

The Extended Technology Acceptance Model (xTAM)

The current study's research framework is based fundamentally on the integrated model proposed by several authors (Vanduhe et al., 2020; Wu & Chen, 2017; Dishaw and Strong, 1999). However, numerous modifications were made in the present study, including external and contextual factors that explain gamification success in developing nations. Another example was a proposed research model based on the Unified Theory of Acceptance and Use of Technology (UTAUT) and trust to integrate gamification into learning management systems (Ofosu-Ampong et al. 2020). Besides, other scholars combined TAM and motivational theories like self-determination theory to investigate learner's continuance intention to use gamified technology (Fathali & Okada, 2018). Then again, this study focuses on instructors' adoption of gamified technology. However, the primary focus of the task technology fit model in this study is to achieve a favourable result of applying gamification—this result by anticipating a good fit between the task and the technology. Therefore, adopting TTF to investigate instructor acceptance of a gamified online learning system is a highly viable strategy.

Although TAM and TTF are two prominent IS models used to explain user behaviour, they have limitations. TAM, for example, fails to consider task characteristics and how well the technology satisfies the task's requirements. In addition, TTF does not include consumers' attitudes toward technology, a fundamental aspect of TAM. As a result, the weaknesses of the two models can be compensated for by connecting them. Furthermore, integrating technology acceptance models with task technology fit will provide further variance explanation to the use of technology in a given context than when standing alone (Junco & Cotton, 2011). In this study, the proposed theoretical model is used to study instructors' intention to adopt gamification for online learning. In addition, the authors introduce a new construct (task technology fit) to assess the task fit in gamification. Table 1 summarises existing literature integrating TAM and TTF to assess behavioural intention, actual usage, and continuance intention.

THEORETICAL FOUNDATION AND HYPOTHESIS

This study focuses on factors influencing the adoption of game design features in online learning. TAM was extended with TTF to integrate computer use and related support components. TAM and TTF overlap significantly from the related literature and, if combined, can produce a significantly more robust model than either independently (Vanduhe et al., 2020; Dishaw & Strong, 1999). Furthermore, TAM is one of the most widely used models to investigate user acceptance of technology (Davis, 1988). The inclusion of subjective norms and perceived enjoyment construct in the research model allows a better

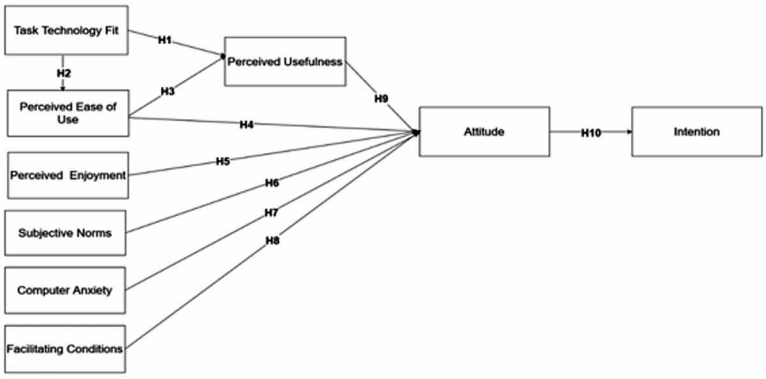
Table 1. Studies integrating TAM and TTF

Author	Domain	Sample Size & Country	Constructs	Measurement Construct	Findings
Vanduhe et al., 2020	Gamified Online Learning	321 Instructors & Students North Cyprus	TTF, PU, Social Influence, Attitude, PEOU, Social Recognition	Continuance Intention	PU, PEOU, TTF, SR, SI and Attitude significantly influenced CI. GFI=0.87
Rahman et al., 2018	Gamified Online Learning	50 Students Malaysia	Gamification PEOU, Gamification PU, Gamification Attitude	Interaction Engagement, Skill Engagement	Gamification PEOU better indicator of student attitude toward using gamified online learning
Wu & Chen, 2017	MOOC Online Learning	252 Students China	TTF, PEOU, PU, Openness, Reputation, Technology Fit, SI, SR, Attitude	Continuance Intention	PU and Attitude significantly affect CI. PEOU significantly affected by TTF. PEOU and SI do not significantly affect Attitude. GFI=0.92 (95.7% variance)
Yuan et al., 2014	M-banking	434 China	TTF, PEOU, PU, Gender, Perceived Risk, Satisfaction, Confirmation	Continuance Intention	Satisfaction, PU, PTTF, and PR are main predictors of CI. PU significantly affected by PEOU and PTTF GFI=0.89
Shih & Chen, 2011	M-commerce	421 Real estate sales personnel Taiwan	TTF, PEOU, PU, Tool Experience, Tool Functionality, Task Requirements	Behavioural Intention	TTF significantly and directly affects BI, PU and PEOU. Tool Functionality significant predictor of PEOU. Tool Experience not significant determinant of PU. CFI=0.98
Yen et al., 2010	Wireless Technology	231	TTF, PU, PEOU, Task Characteristics, Technology Characteristics	Behavioural Intention	Significant relationship between TAM and TTF. PEOU significantly affected by PU. Tech Characteristics influences PEOU, PU. BI determined by fit between Task and Tech Characteristics, PU and PEOU. GFI=0.89
Klopping & McKinney, 2004	E-commerce	263	TTF, PEOU, PU, BI	Actual Usage (AU)	No significant relationship between TTF and PU. TTF significantly affects PEOU. GFI =0.99 (52% variance)
Dishaw & Strong, 1999	Business Information System	60 United States	TTF, PEOU, PU	Actual Usage (AU)	PEOU significantly affected by TTF. Low correlation between PU and TTF. PU and IT Tool influenced by Tool Functionality. GFI =0.94 (51% variance)

understanding of the impact of these factors. Hence, they can potentially be one of the main predictors of using gamified online learning systems.

Additionally, Computer Anxiety and Facilitating Conditions were considered due to their ability to significantly influence user acceptance of gamified online learning in developing countries. These constructs, considered together, seek to determine instructors' intention and ultimately predict their behaviour. The relationships between these constructs are integrated into the conceptual model depicted in Figure 1.

Figure 1. Proposed theoretical model



TTF model is used to examine how technology enhances performance. Specifically, TTF is employed to evaluate user performance (Goodhue & Thompson, 1995). The efficacy of technology acceptance is based on user acceptance and how perfect the task fits. Subsequently, researchers have widely used the TTF to forecast the acceptance and usage of new technology (Wu & Chen, 2017). Despite the literature on TTF in IS, there is limited focus on instructors' acceptance of gamified learning systems. A recent related study demonstrated the significance of TTF on user intentions (Vanduhe et al., 2020). To date, TTF's impact on instructors' use of gamified systems remains understudied. Therefore, the authors assume that users are more likely to use the gamified system if technology matches the task. With this understanding, the following is proposed.

H1: TTF will significantly affect the perceived usefulness of using gamified online learning.
H2: TTF will significantly affect the PEOU of using gamified online learning.

Perceived Ease of Use (PEOU) is the extent to which a consumer perceives using a specific system will need no physical or mental effort. Therefore, the system should be simple to use and therefore does not necessitate any specialist skills before application (use). Previous studies indicate that the PEOU directly affects on users' attitudes and the perceived usefulness of technology (Vanduhe et al., 2020, Wu & Chen, 2017). Further, in the gamification context, PEOU is the degree to which the instructors expect the gamified system to be free of effort (Vanduhe et al., 2020; Rahman et al., 2018). Accordingly, PEOU can be a better indicator of students' and instructors' attitudes towards a gamified online system. Based on these, this study hypothesises that:

H3: PEOU will significantly affect the perceived usefulness of using gamified online learning.
H4: PEOU has a positive effect on user attitudes towards intention to use gamified online learning.

Perceived Enjoyment (PE) is a person's overall perceived gratification and satisfaction with using a service (Davis, 1989). TAM may be less robust when applied in hedonic system-use contexts. Hedonic systems are usually more enjoyable, fulfilling, and stimulating to use. Thus, perceived usefulness and PEOU may not be the only important factors influencing the usage of hedonic systems (Wu & Lu, 2013). As such, PE becomes a key variable in hedonic system usage intention. PE is the most widely employed external component in the TAM (Chao 2019; Tsai et al., 2018). Extant literature did not indicate the widespread use of PE in examining instructors' use of gamified learning. However, the limited body of evidence suggests that PE is essential in inspiring students' intentions to use gamified learning (Cabada et al., 2018). From that perspective, this study assumes that instructors are more likely to accept gamification if they perceived that the gamified system to be pleasurable to use. Therefore, the following is proposed:

H4: PE has a positive effect on user attitudes towards intention to use gamified online learning.

Subjective Norms (SN) are the perception that a significant individual or set of people would support a specific behaviour (Ham et al., 2015). The SN is influenced by an individual's perceived social pressure from others to behave in a specific way and their reasons for conforming to those people's opinions. Therefore, individuals who perceive that valued individuals believe they ought to act on behaviour may feel more motivated. In related literature, subjective norms were significant in predicting user intention (Mo et al., 2019; Ham et al., 2015). It is also crucial in developing behaviour change strategies. Thus, in this study, the authors postulated the following hypotheses:

H5: Subjective Norms positively affect user attitudes towards intention to use gamified online learning.

Computer Anxiety (CA) includes invoking uneasy or irrational feelings to performing any computer-related activity (Rizun & Strzelecki, 2020). Indeed, CA plays a significant role in IS adoption (Venkatesh et al., 2003). Among the IT literature, authors affirmed CA is a barrier to technology adoption for academic purposes, particularly in developing nations (Huang & Mayer, 2016). Moreover, gamification literature reported the indirect effects of CA on behavioural intention (Adukaite et al., 2017). It follows that most instructors experiencing computer anxiety may be slower to accept and utilise gamified online learning systems. Based on this, the authors deduced the following hypotheses:

H7: Computer Anxiety positively affects user attitudes towards intention to use gamified online learning.

Facilitating Conditions (FC) is an individual's collective perception that the organisational and technological resources required to use a particular technology are available (Yakubu et al., 2019; Venkatesh et al., 2003). Like most digital learning technologies, instructors use of gamified online learning platforms may suffer from specific issues such as favourable infrastructures, cost, and support tools. In this sense, a favourable set of conditions, such as infrastructure, power supply, IT support personnel, contributes to a greater likelihood to accept and use a system. However, if this infrastructure is unavailable, instructors will be less inclined to utilise the system. Several studies established the importance of facilitating conditions in influencing behavioural intentions and actual use (Alkawsi et al., 2021a; Mensah, 2019;

Kurfali et al., 2017). For example, Mensah (2019) found FC to be a significant predictor of intention to use e-government services and can also fit the context of online learning services. Especially, FC may be critical for developing conditions where the resources (technical and infrastructural support) to sustain gamified systems may be lacking. Therefore, according to the presumptions as mentioned earlier, the following hypothesis was developed:

H8: Facilitating Conditions positively affect user attitudes towards intention to use gamified online learning.

Perceived Usefulness (PU) relates to an individual's belief that using a system will enhance their job performance more than any direct benefits associated with system utilisation (Davis, 1989). For example, the gamification literature suggests instructors perceive that adopting gamified online learning will improve their overall performance. Also, evidence shows that PU can be beneficial in predicting behavioural intention to use gamified learning systems (Vanduhe et al., 2020). It follows that an instructor will be more inclined to accept and use gamified online learning to achieve their academic goals. In this sense, it is assumed that PU will significantly influence the instructors' intention to use gamified online learning systems. Therefore, this study proposes that:

H9: PU has a positive effect on user attitudes towards intention to use gamified online learning.

Attitude (ATT) is the overall feeling of liking or disliking a behaviour (Mo et al., 2019). These attitudes are developed based on the beliefs regarding the consequences (intrinsic and extrinsic rewards) of the considered behaviour (Ajzen, 2005). In gamification, these consequences generally have a positive impact on user acceptance of gamified online learning. Previous studies found attitude as one of the most dominant predictors of technology usage (Wu & Chen, 2017). In related literature, Vanduhe and colleagues (2020) found attitudes to positively affect continuance intentions to use gamification for training. This study, therefore, assumes that attitude will also have a significant effect on instructors' intention to use gamified learning. As such, this study asserts that in a gamified online learning context, the intention to engage with the system is likely to attract a more favourable attitude towards it. Hence, the following hypothesis is proposed:

H10: Attitude has a positive effect on users' intention to use gamified online learning.

METHOD

In this study, a survey is employed to test the hypotheses formulated in the previous sections; questionnaire development and data collection are discussed in the subsequent sections.

Survey Instrument

This study employed a questionnaire survey with two sections to test our theoretical model. The rationale for employing the survey was to collect information and demographic features from a large study sample in a relatively short period (Ponto, 2015). Using the survey method also allows us to obtain data

from diverse academics from various African nations. Furthermore, this is an appropriate data collection instrument to employ during the COVID-19 pandemic. A pilot study was presented to 45 African educators before the survey was distributed to produce better questions and eliminate ambiguity, as in previous studies (Alkawsi et al., 2021a; Alkawsi et al., 2021b; Alkawasi & Baashar, 2020). As a result, a response rate of 89% was recorded. Validation testing was performed using expert and content validity to identify items that were likely unclear or redundant in order to verify conceptual equivalence. Participants in this study were instructors from various African institutions. The study was mainly interested in instructors who had not previously utilised gamified online learning platforms.

Data Collection

The participants of this study were instructors at various African institutions. The online test was distributed to approximately 430 prospective participants via Google forms. Email, Facebook, and WhatsApp groups were used to disseminate the questionnaire. The email addresses of the teachers were retrieved from the official websites of their respective universities. To improve the number of responses, reminders and follow-up emails were sent. Data was gathered from February to June 2021; 50 valid replies were received, indicating a poor response rate of 11.6%. The poor response rate could be attributed to instructors not checking their official emails regularly. Furthermore, some instructors, particularly in developing countries, have limited access to the internet (availability). The demographic data of the respondents are summarised in Table 1.

Descriptive Statistics

The sample consisted of 50 participants. The respondents' ages ranged from 26 to 65, and their mean age was 39.5 (SD = 7.8). 18% of the sample was over 45 years old. Over two-thirds (81%) of the sample were male (n= 42) and 16% females (n=8). The majority of respondents are based in Nigerian universities (78%), followed by South African (8%) and Ethiopian universities (4%). Most of the courses taught by the respondents include Sciences (20%), Engineering (18%), Computer/IT (16%), Economics/Financial Management (16%), and Medical (14%). Furthermore, the four main platforms used for online learning in various African institutions were Zoom, Moodle, Google Classroom, and Blackboard. Table 2 presents the demographic information of respondents (n=50).

RESULTS AND DATA ANALYSIS

The evaluation of the study model was done in two steps. First, the measurement model was evaluated by examining the psychometric properties of the variables. Second, the structural model was assessed by looking into collinearity issues, relationships between all the constructs, and the predictive relevance of endogenous variables.

Evaluation of Measurement Model

The reliability of the variables was measured through Cronbach's α (CA) and composite reliability. The acceptable range of internal consistency in exploratory research is 0.6-0.7 (Hair et al., 2016). Likewise,

Table 2. Demographic information of respondents

Characteristics		Frequency	Percentage (%)
Gender	Male	42	84
	Female	8	16
Age	26-35	16	32
	36-45	25	50
	46-55	7	14
	56-65	2	4
Country	Nigeria	39	78
	South Africa	4	8
	Ethiopia	2	4
	Botswana	1	2
	Cameroon	1	2
	Eswatini	1	2
	Ghana	1	2
	Namibia	1	2
Courses Taught	Sciences	10	20
	Engineering	9	18
	Computer Science and Information Technology	8	16
	Economics, Finance and Management	8	16
	Medical Sciences	7	14
	Education, Curriculum and Graduate Studies	6	12
	Social Sciences, Arts and Languages	2	4

Table 3. Psychometric properties (n=50)

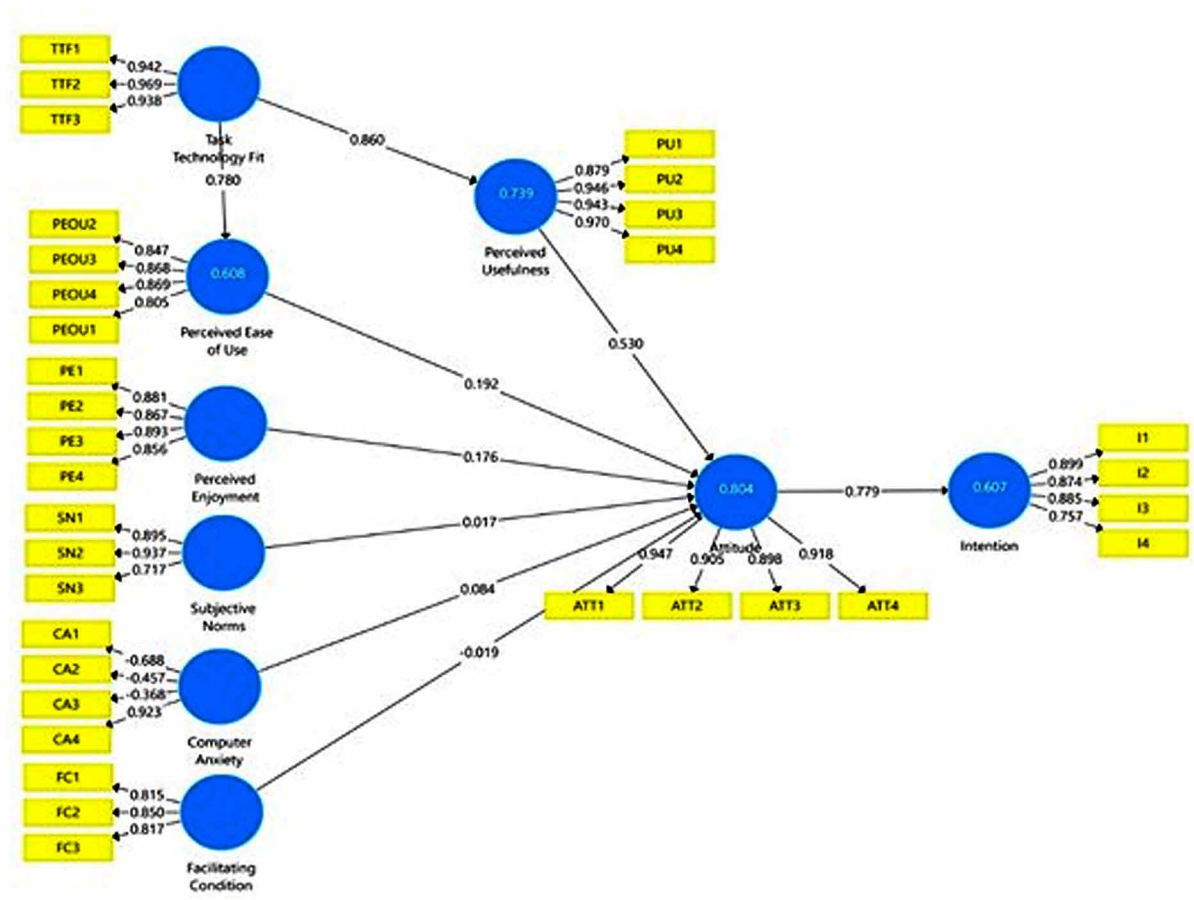
Construct	Reliability		Convergent Validity			Discriminant Validity
	Cronbach α	Composite Reliability				
			K	Loading Range	AVE	HTMT <0.90
Task Technology Fit	0.95	0.96	3	0.94 – 0.97	0.90	No
Perceived Ease of Use	0.87	0.91	4	0.81 – 0.87	0.72	Yes
Perceived Enjoyment	0.90	0.93	4	0.86 – 0.88	0.76	Yes
Subjective Norms	0.82	0.89	3	0.72 – 0.94	0.73	Yes
Computer Anxiety	0.28	0.13	4	- 0.37 – 0.92	0.42	Yes
Facilitating Conditions	0.78	0.87	3	0.82 – 0.85	0.68	Yes
Perceived Usefulness	0.95	0.97	4	0.88 – 0.97	0.87	No
Attitude	0.94	0.95	4	0.89 – 0.95	0.84	No
Intention	0.88	0.92	4	0.76 – 0.91	0.73	Yes

Note: K=number of indicators, AVE=Average Variance Extracted

the convergent validity was measured through AVE (Average Variance Extracted). AVE value 0.5 indicates that the construct explains 50% of the variance of the indicators, whereas the rest of the variance is in error terms. The discriminant validity of the constructs was examined with the Heterotrait-Monotrait Ratio of Correlations (HTMT) criterion. Henseler et al. (2015) suggested that if the value of HTMT is below 0.9 between two constructs, it implies that discriminant validity has been established. The psychometric properties of the constructs are reported in Table 3.

The values of Cronbach's α and composite reliability reported in the above table represent that all the scales have met the criteria for internal consistency. The AVE of all the constructs is above the criterion, which is 0.5 except that of CA. Nevertheless, the AVE value of 0.4 is also acceptable in some of the cases. Given the low reliability of CA based on its acceptable convergent and discriminant validity, it should be excluded from the model. However, CA can be retained in the model as part of scientific theory (Yakubu et al., 2019). All other constructs have acceptable convergent validity. Values of HTMT ratio of all constructs are less than 0.9 except for three factors. Noticeably, the current study is related to the different interlinked features of game design; hence their discriminant validity can be overlooked.

Figure 2. PLS results of the research mode



Structural Model

While examining the structural model, collinearity assessment (VIF), Coefficient of Determination (R2), and predictive relevance (Q2) were explored. The PLS results of the research model are presented in Figure 2.

Collinearity Assessment

The correlation between independent variables of the model was assessed to figure out the multi-collinearity issue. It was determined through VIF statistics. According to Hair and colleagues (2016), the value of VIF should be less than 5. Table 4 shows that the VIF value for perceived enjoyment is slightly above the criteria whereas, for all other variables, it is within the acceptable range. Considering the game design features, the inconspicuous correlation of perceived enjoyment with other factors is ignorable.

Table 4. Collinearity statistics (n=50)

Variables	Project Success
Task Technology Fit	2.55
Perceived Ease of Use	2.55
Perceived Enjoyment	5.06
Subjective Norms	2.34
Computer Anxiety	1.40
Facilitating Conditions	1.49
Perceived Usefulness	4.51

Predictive Capabilities of the Model

The predictive capabilities of the model were calculated in two ways. At first, R2 was examined, which means the predictive power of all the exogenous constructs for linked endogenous constructs. It was obtained by Bootstrapping procedure. Secondly, the model's predictive relevance (Q2) was calculated by eliminating specific data points from the model. It was obtained by calculating through Blindfolding Procedure with an Omission Distance of 7. The results are illustrated in Table 5.

Table 5. Coefficient of Determination (R2), Cross-Validated Redundancy (Q2), of the Study Variables (N=50)

Construct	R^2	Q^2
Perceived Usefulness	0.79	0.58
Perceived Ease of Use	0.61	0.39
Attitude	0.80	0.64
Intention	0.61	0.35

Note. *p<.05, **p<.01, ***p<.001.

According to Hair et al. (2011), R2 and Q2 values of 0.25 can be considered weak, 0.50 as moderate, and 0.75 as strong. Therefore, values reported in the above table show that all the independent variables are moderate to strong predictors of the dependent variables.

Hypotheses Testing

Path coefficients represent the prediction of specific endogenous constructs by specific endogenous constructs. Its significance is determined by the t value corresponding to the specific significance level (p-value). Confidence intervals can also determine the significance of path coefficients. Notably, the confidence Interval should not include "0" for the significant path coefficient. F2 is effect size. Effect size f2 of less than 0.02 represents that there is no effect. However, 0.02, 0.15, and 0.35 represent small, medium, and large effect sizes.

Table 6. Path co-efficient and effect sizes

Path	Path Coefficient β	p Value	Confidence Intervals		f^2	Supported
Task Technology Fit → Perceived Usefulness	0.86	0.00	0.73	0.96	0.64	Yes
Task Technology Fit → Perceived Ease of Use	0.78	0.00	0.65	0.88	1.55	Yes
Perceived Ease of Use → Attitude	0.19	0.19	-0.09	0.48	0.03	No
Perceived Enjoyment → Attitude	0.18	0.32	-0.24	0.47	0.03	No
Subjective Norms → Attitude	0.02	0.86	-0.20	0.22	0.00	No
Computer Anxiety → Attitude	0.08	0.52	-0.23	0.26	0.03	No
Facilitating Conditions → Attitude	-0.02	0.83	-0.18	0.18	0.00	No
Perceived Usefulness → Attitude	0.53	0.00	0.25	0.94	0.32	Yes
Attitude → Intention	0.78	0.00	0.73	0.85	1.54	Yes

Findings in the Table 6 reveal that only four hypotheses (H1, H2, H9 and H10) were supported. Basically, task technology fit significantly predicted perceived usefulness and perceived use of ease. Furthermore, perceived usefulness significantly predicted attitude. Also, attitude significantly predicted intention. At the same time, perceived ease of use, perceived enjoyment, subjective norms, computer anxiety and facilitating conditions did not affect attitude.

DISCUSSION

A total of ten hypotheses were examined in this study. Accordingly, the authors found evidence for four of the relationships between the constructs. Thus, as in Figure 1, eight independent variables are hypothesised to influence instructors' behavioural intentions to use gamified online learning systems.

Following H1, TTF positively and significantly affected PU, with a large effect size. The indirect effect of TTF on ATT was shown to be significant via the PU of gamified online learning. This outcome supports the conclusion from previous research that task relevance directly affects PU (Dishaw & Strong, 1999).

Nonetheless, our findings contrast those of Vanduhe et al. (2020), who found no significant association between the two variables (TTF and PU). Therefore, the TTF of a gamified learning system improves instructors' behavioural intentions toward its use.

Concerning H2, TTF was found to predict the PEOU of a gamified online system significantly. Furthermore, the findings of our study revealed the critical significance of TTF. According to earlier research, TTF is positively associated with ATT towards using gamified online learning (Vanduhe et al., 2020). As a result, if the gamification learning system fits well with the instructor's task, the technology is more likely to be adopted and used.

Regarding H3, the lack of a strong correlation between PEOU and PU contradicts past research indicating that PEOU has a significant impact on PU (Buabeng-Andoh, 2018). Based on existing literature, if individuals perceive the system as easy to use, they are more likely to view it as beneficial and more inclined to utilise it (Garcia, 2017), notably among inexperienced users (Buabeng-Andoh, 2018, Lau, 2008). Assuming that most respondents are familiar with eLearning systems, they are not considered inexperienced users, and thus PEOU may not be a factor of the perceived usefulness of gamification. Although PEOU and PU are strongly supported in various research, they do not appear to have been validated in the context of gamified online learning. Instead, the current study offers a distinct perspective, and future research may confirm or contradict this conclusion.

In terms of H4, data shows that PEOU is not a significant determinant to instructors as PU despite its prevalence in various studies on technology acceptance. In a recent study (Yakubu et al., 2019), PEOU had the most significant influence on behavioural intentions when using eLearning. Their research focused on students' perceptions of Learning Management Systems (LMS) in the context of a developing country. However, our findings contradict this conclusion. It demonstrates how the discrepancy between instructors' and students' perceptions of a system's ease of use influences their behavioural intention to utilise it. One interpretation is that instructors, unlike students, may not need to be fully engaged with the system. Therefore, they are more concerned with the system's task fit and far less interested in its convenience of use. Another key analysis found that perceived ease of use and perceived usefulness were less significant when predicting technology acceptance among a group of teachers (Chen et al., 2012). It implies that instructors would likely adopt a gamified learning system regardless of how complex the system is to use.

For H5, PE, which should be crucial in influencing instructors' usage of a gamified system, was found to have a non-significant relationship with the intention to utilise the system. Given that gamified systems are hedonic-oriented systems (Oluwajana et al., 2019; Hamari & Koivisto et al., 2015), it is expected that PE will be crucial in predicting their utilisation. This finding, however, suggests that instructors feel they do not need to enjoy using the system or that it must be gratifying (intrinsically motivating) to motivate them to utilise it. Literature provides evidence that, in utilitarian systems, extrinsic motivators are more significant determinants than intrinsic motivators (Wu & Lu, 2013, Fagan et al., 2008). Although gamified systems, as previously stated, are hedonic, an online learning system may be perceived in two states: utilitarian during the adoption stage and hedonic during the post-adoption stage. According to this and earlier research, external motivators are considered sufficient to motivate the adoption of a utilitarian system. Our study did not focus on adherence to the system, which likely depends on users finding using the system fun and interesting (intrinsic motivation), so PE may not be significant in predicting gamification adoption.

According to the empirical findings concerning H6, SN has no effect on instructors' attitudes regarding utilising gamification. Regrettably, our findings cannot be compared to those of other studies,

given the limited research on the specific influence of SN in the context of gamified learning. Nevertheless according to the general assumption, individuals are more likely to engage in a behaviour that is considered desirable by significant others. However, in our study, we discovered that instructors do not believe that social pressure from significant others will influence their inclination to use gamified online learning. Therefore, it implies that instructors in developing countries will be willing to utilise gamification regardless of others' opinions. In other words, their intention to use the gamified system will not be swayed or influenced by important persons.

In contrast to our assumptions in H7, the effects of CA on ATT to use gamified online learning is not supported by the data. Because of the nature of our study, this finding could not be compared to prior studies. Notwithstanding, although unexpected, one potential reason for this unexpected finding is that the instructors who completed the survey were more likely to be more proficient with computers, which may have influenced their responses. As a result, they had no difficulty finishing an online survey, whereas those uncomfortable with computers opted not to participate in the online survey. As such, CA's insignificance indicates that aversion to emerging technology usage may no longer be as crucial as it previously was. Surprisingly, our data for H8 revealed no relationship between FC and instructors' intention to use the gamified system. This finding suggests that teachers do not consider FC (internet, technical support) a barrier to implementing gamified systems. Interestingly, instructors in developing nations may have learned to manage with inadequate infrastructures and limited resources (support) and do not consider them significant factors influencing their use of online learning systems.

Following H9, PU significantly predicted instructors' behavioural intention to use the gamified online system. The instructors believe that the system's usability will motivate them to use gamified learning systems. This finding is consistent with prior research in which PU was found to predict behavioural intention significantly (Wong et al., 2020; Rahman et al., 2018; Fagan et al., 2008). According to one study, instructors' attitudes towards adopting gamified systems depend entirely on the PU of gamification (Vanduhe et al., 2020). Our findings support a similar conclusion that gamification is strongly related to users' views of its use rather than ease of use.

For H10, it was found that ATT significantly predicts behavioural intention to use a gamified online learning system. The statistically significant correlation between ATT and Behavioural Intention validates previous research confirming the positive effect of learners' attitudes toward gamification (De-Marcos et al., 2014). This observation shows that an instructor's positive attitude toward gamified online learning is a significant predictor of behavioural intention. A positive attitude would help in building a stronger intention to adopt technology (Davis, 1989).

Implications

In terms of theoretical contributions, the current study adds to existing knowledge in gamification studies by investigating the predictors and intentions of gamified online learning adoption in the educational setting. Overall, little attention has been paid to the factors influencing the adoption of gamified eLearning, particularly in Africa. More specifically, this empirical study aimed to explore the challenges with gamification adoption intentions. Furthermore, it is evident that earlier research mainly focused on students in a non-gamified online learning context. Therefore, this research contributes to the body of knowledge on theory integration such as TTF and TAM. Furthermore, this study provides a more in-depth explanation of the direct and indirect links between the examined constructs and their associ-

ated indicators regarding the determinants of instructors' intention to use gamification online learning platforms in African institutions.

This research showed that ATT was the most significant predictor of gamification intention. Thus, it appears critical for institutions to foster positive attitudes on the use of technology among instructors. According to Alzahrani and O'Toole (2017), users who have a positive attitude toward technology are more inclined to use it. Remarkably, PEOU did not affect perceived utility. These findings differ from prior research, suggesting that users likely reject its use despite a technology's usefulness if they regarded it as challenging to use. Most importantly, the gamified online learning should be suited for the instructors' tasks while also being usable and beneficial. Also, the gamified system should support integrated learning. Notably, Computer Anxiety, Subjective Norms, and Facilitating Conditions impacted instructor's intention to engage in gamified online learning. Surprisingly, this implies that instructors are unconcerned with the influence of significant others on them using gamification. Furthermore, they are not worried about facilitating conditions such as a reliable internet connection and electricity affecting their utilisation of gamified learning systems.

Implications for TTF

In TFF, we established that aligning gamification functions to specific tasks allows instructors to perceive its usefulness and ease of use. Similar conclusions were reached by Wu & Chen (2017), confirming that TTF impacts PU, PEOU, and PU in the eLearning domain.

Implications for TAM

In TFF, we observed that matching gamification functionalities to specific tasks will enable instructors to perceive its usefulness and ease of use. Similar conclusions were reached by (Wu & Chen, 2017), indicating that TTF affects PU and PEOU and PU in the eLearning domain. Since instructors prefer to focus on the utility of the system itself rather than its simplicity of use when creating an attitude toward utilising eLearning, PU influence on Attitude is more significant. It appears to be the case for online learning systems that are gamified. As a result, perceived usefulness was significant in predicting the use of gamification. The findings, on the other hand, show that perceived ease of use did not influence PU. Hence, if gamification offers significant functionality, instructors will be ready to accept some difficulty in using it. Consequently, instructors did not value PEOU.

CONCLUSION

Educators should develop more innovative approaches to improve instruction quality, learning experience, and engagement to adapt current learning to new pedagogical needs. In this regard, gamification is offered as an innovative strategy for achieving this goal. Likewise, gamification has the potential to improve student performance and engagement, particularly in developing countries. Given this, it is critical to understand instructors' perspectives on gamification adoption at various African institutions. There is, however, limited evidence in this context, particularly from the perspective of teachers. As a result, the purpose of this study is to determine the predictors of gamified online learning adoption in African institutions.

The application of TAM and TTF to adopt a gamified online learning system presented in this research expands our understanding of the mechanics of technology and attitudinal shift as they pertain to fostering a key area for online learning. In the integrated model, four of the ten offered hypotheses were found to affect behavioural intention positively. TTF, PU, and ATT significantly influence the intention to employ gamification in an online learning environment. However, despite its prominence in many studies on IS adoption, PEOU had no substantial impact on behavioural intention.

Furthermore, SN, FC, and CA did not influence the intention to use a gamified online learning system. The model assists researchers and practitioners in better understanding why people choose to use gamified online learning systems for pedagogy. This insight is especially significant in understanding how individual attributes interact with task features to influence instructors' decisions to utilise or not use the system to improve educational outcomes.

Limitations

Although this work provides several contributions, it does have several limitations that could be addressed in the future. First, as gamification is a novel concept, the initial explicit limitation is the lack of supporting literature for the outcomes. Second, given the low response rate, the results could be affected by a non-response bias. This also limits the findings' generalisability. Hence, prospective studies should involve a larger sample size to increase the findings' significance and generalizability. Second, most respondents appear to be comfortable using computers, which may have influenced the study's conclusions. As a result, further research is required to understand how computer experience influences user intention.

Finally, despite being validated in prior studies, the new variables did not affect behavioural intention. As a result, future research should incorporate more predictive factors from diverse theories and models into the existing theoretical model to improve its predictive power.

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KEY TERMS AND DEFINITIONS

eLearning: A learning approach based on formalised instruction and uses electronic resources.

Game Elements: The components or characteristics of a game.

Gamification: The introduction of game design features in a non-game context.

Gamified Learning: Integrating game elements in learning to make it more entertaining and exciting.

Information System: A software used to organise and analyse data.

Task Technology Fit (TTF): The extent to which a certain Information System or technology facilitates the task at hand.

Technology Acceptance Model (TAM): A theory of information systems that describes how consumers come to accept and use technology.