Examining Information Quality and Perceived Learning Performance in a Gamified Environment

Conference Paper · June 2020

DOI: 10.1109/CBI49978.2020.10052

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Abstract—**Despite the significant research on motivation, engagement, and satisfaction in gamification, the quality of the information provided by instructors and designers to students on the gamified application has not received commensurate attention. One potential reason is that quality is an abstract notion that cannot be expressed by simple definition. This paper focus on the critical aspect of the gamified learning environment: using gamified information to enhance students learning behaviour by providing information systems such as Kahoot Mobile Learning application. Our study, based on the contextual and representational information quality, examined 139 users of a gamified information system and found the differential need for information quality when designing content for students. Additionally, the study revealed the four characteristics (website, user, social and task) of information quality as critical dimensions in determining learner's satisfaction in the gamified application, which in turn influences perceived learning. Our findings provide educators and instructors with important guidelines which when considered on a contextual basis would motivate learners to obtain further information from gamified systems that may lead to perceived learning performance.**

Keywords-gamified system; information quality; perceived learning performance;learning satisfaction

I. INTRODUCTION

Higher education institutions in their quest to enhance learning with information technology (IT) have developed mechanisms and research investigations to examine the factors that mediate between educational investment and the economic value it creates. Gamification, which is the "use of game elements in non-game contexts" [37] is one of the recent additions of IT investment in education, and its primary objective is to increase satisfaction and engagement in learning. To identify factors that account for IT investment, researchers most often draw the line between users' behaviours towards IT (attitude and perception) and how it impacts learning and education [23]. Even though, researchers have identified many ways of addressing user perception; user enjoyment (e.g., [26]) and user engagement (e.g., [22]) are the two dominant assessment approaches used in education. While each research approach contributes to our understanding of gamification in education, they form part of gamification research. Additionally, research on information quality and user enjoyment or satisfaction has a long tradition of determining the evaluative success of information systems [31], [8] and have proved that information accuracy affect decision quality significantly [14]. To this end, the purpose of our study is to integrate the two research approaches and provide a comprehensive understanding of *how information quality contributes to satisfaction and perceive learning in gamification applications.*

Despite the significant research on motivation, engagement, and satisfaction in gamification [19], the quality of the information provided by instructors and designers to students on the gamified application has not received commensurate attention. One potential reason is that quality is an abstract notion that cannot be expressed by simple definition. Therefore, defining quality requires the need to solicit user perceptions and the specific context of deploying gamification. Due to the high attrition rate on online learning, poor quality of information becomes [11] a pressing problem for gamified learners and a critical issue of online learning and educators [4]. It is, therefore, essential to investigate the quality of information available to the gamified user and potential outcomes. To do so, we adopt Wixom ad Todd's [34] dimensions of information quality and the four cultural factors that influence information quality as proposed by [11] and integrate with user satisfaction and learning engagement to develop a

theoretical model for testing. Importantly, our study categorizes information quality into representational (format and currency) and contextual (accuracy and completeness) quality dimension; and user characteristics (UC), task characteristics (TC), website (gamified) characteristics (WC) and social characteristics (SC) and analyse that effect. To better understand the role of learning systems and place within the context of the task at hand for learners, this study focuses on the Contextual IQ and Representative IQ and theoretically model the relationship. This study will open up a new stream of questions on online quality dimensions, and perceived learning performance enabled by gamified technologies that have not been examined systematically in information systems education. Thus, to improve the quality of information produced by the gamified application, we need to understand what information quality means to the student when acquiring knowledge.

II. RESEARCH MODEL AND CONCEPTUAL FRAMEWORK

This study develops a research model (see Figure 1) that explains information quality, satisfaction, and perceived learning performance within a gamified application.

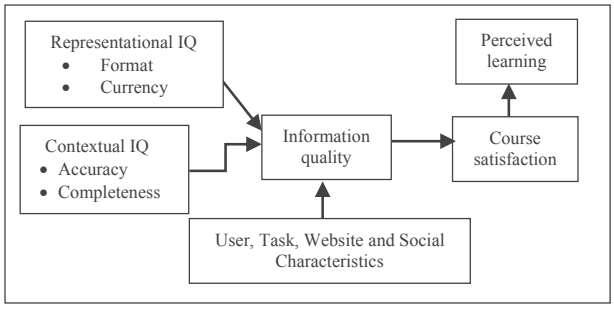

Figure 1. RESEARCH MODEL

III. INFORMATION QUALITY AND USE BEHAVIOUR

Building an engaging gamified IS for learning entails successful models. One of the models developed is the IS success model [8]. The model proposes that studies in IS should "systematically combine individual measures from I/S success categories to create a comprehensive measurement instrument" [8]. Based on the foundational works of Mason [20], information refers to the IS output or communication, which is measured at different levels (technical, effectiveness, or semantic) of system use [8]. The technical level refers to the efficiency and accuracy of information produced by the system; the semantic level measures success about the intended meaning of the information, and the effectiveness level relates to the effect of information on the receiver [28].

Earlier studies assessing the integration of digital games in learning highlights the investment in educational technologies. With these assessments, digital game *usage* became an essential area of gamification research after prior studies on investment found mixed effects on digital game performance [21]. Beyond the acquisition of gamification resources and the use of game elements, related studies have recognized gamification design as a precursor for user engagement [19] and learning performance [27]. Consequently, recent research has identified information quality as an important aspect of digital design for engagement. User loyalty and satisfaction, trust, and enjoyment in online games, gamification adoption, and knowledge sharing behaviour [27], [19] are examples of outcomes influenced by information quality.

Although information quality has several characteristics, we propose that it is shaped by four dimensions in this study context which is to help us understand online learning systems better [34]. These dimensions are completeness, format, accuracy, and currency. Completeness is the extent to which the gamified IS provides the required essential information for the learner to perform the assigned task in the learning process. Format presents the information provided by the gamified IS. Accuracy is the correctness of the information provided by the gamified IS to encourage user behaviour. Currency relates to how recent or updated the information provided by the gamified IS [34]. These four dimensions form the quality of the information provided to the students across the educational setup. Thus, we hypothesis that the four dimensions are positively related to information quality. For instance, a gamified orientation process for first-year students may provide information about academic, social, campus activities or groups, and personal support for students to motivate their learning engagement at university. Information inaccuracy may occur due to instructor sloppiness in designing a well-formatted (meets user queries), appealing system [19] that follows systematic gamified course materials based on user preferences and capabilities. Likewise, the currency of information may distort the quality of information for the students. For example, a gamified syllabus for students of the previous academic year may not have the most recent information on course materials for current students.

Further, prior research has approached information quality as a single construct that lacks further dimensions such as user satisfaction [18]. However, other scholars such as [18] have included contextual, intrinsic, accessibility, and representational as a further dimension of information quality. Although the researchers included and test measurement models, their study did not explain perceived learning performance as a dependent variable or manifestation of the student learning environment. Hence, a call for future research to look at information quality from different dimensions. Thus, we will assess this study in light of representational information quality and contextual information quality (see Table 1) on the student gamified learning environment. We, therefore, hypothesize that information quality is positively associated with course satisfaction within a gamified application.

TABLE I. DEFINITIONS AND INFORMATION QUALITY DIMENSIONS

IQ Dimension	Definition
Contextual IQ	*"The quality of information differs based on the task at hand. Timeliness, value-added, appropriate amount of data, relevancy, completeness" [31].*
Representative IQ	*"The extent to which the information is shown in a clear manner. Concise representation, interpretability, representational consistency, ease of understanding" [31].*

A. Impact of Contextual Factors on Information Quality

As a build-up of the IS success model, we focused on the four dimensions proposed by [11] that influence gamified information quality: User, Task, Website and Social Characteristics. The scholars proposed that these factors are contextual and has been neglected by researchers when measuring the quality of information or considering the factors that influence information quality. To quote them, they claim "the result of such disjointed consideration, and the impact of context on online information quality perception is unrecognized" [11]. In this study, context is defined as "the set of factors surrounding a phenomenon that exerts some direct or indirect influence on it – also characterized as explanatory factors associated with higher levels of analysis than those expressly under investigation" [33]. Our study seeks to test the relationship between the proposed dimensions.

First, user characteristics (UC) in a gamified environment is considered a contextual factor that potentially affects how a student perceives information quality [38] in a gamified IS. Consequently, UC represents an essential dimension in the implementation and design of information systems due to its vital role in promoting user relevance [8]. Prior research indicates the receptiveness of e-commerce systems in leveraging user-specific data to personalized designs; users, in turn, perceive such systems as having higher quality and personalized experience [29]. According to [19], UC is an important engagement tool in increasing personal relevance and results in leveraging data of specific users in developing clusters modelled on the user. Thus, since gamified users have different preferences; and are not homogeneous groups when accessing the gamified system for learning different disciplines, UC should be vital in the design to encourage gamified quality judgments [13]. For example, based on the characteristics of users, a game may be classified as explorers, achievers, killers, and socializers [36]. To this end, we hypothesize the positive relationship between UC and information quality.

Second, Task Characteristics (TC) refers to specific tasks that motivate a student to rely on a specific aspect (see [39] on desirable outcomes) of the course material of the gamified application [12]. In the gamified environment, students' primary intent on the system is to search for information, attend to assignments, and engage in interactive challenges with colleagues. Thus, gamified systems must be congruent with quality information (task assigned) to students. To this end, the kind of game elements selected should be meaningful and convey the cultural perspective of the students to support relatedness to the system. Additionally, feedback is considered a prevalent outcome of gamified systems when seeking for quality information. Existing theories already underscore the importance of feedback as an antecedent of information quality in information systems [26]. To conclude, [25] found that when individuals are searching for health information, they prioritize the accuracy of information as compared to product information. We, therefore, hypothesize the positive association between TC and information quality.

Third, Website Characteristics (WC) in a gamified environment affects how students perceive the gamified information quality [17]. The notion is that if students perceive the gamified system to be visually appealing and innovative, there may be a possibility of increasing their information search behaviour, which in turn may perceive the gamified system as high-quality information [11]. We, therefore, hypothesize a positive relationship between WC and information quality within a gamified IS.

Finally, Social Characteristic (SC) looks at the interplay of the personal, environmental influences, and behavioural in determining the use and perception of systems. In order words, it focuses on the social processes a student goes through to make perception of the gamified system [30]. For example, [35] examined the relationship between quality dimensions and social influence and found that Facebook users' perception of online information is affected by social influence (peer norms). To this end, we hypothesize the positive association between social influence and information quality.

C. Course Satisfaction

Satisfaction from activities in the classroom is essential for fostering problem-solving and encouraging learning [10]. In this regard, information and the satisfaction from the gamified system exemplify object-oriented attitudes that constitute extraneous variables influencing behavioural beliefs. The satisfaction derived from the information by the gamification application will shape the value perceptions of use and relevance. This means that the higher a student's satisfaction with the course information, the likelihood is that he or she would find the gamified system information more useful in improving learning performance [34]. That is, the course satisfaction signifies the favourable degree in congruence to the system information and interactions between the game mechanics and dynamics. The more a student finds satisfaction with the gamified system itself, the more likely one will perceive learning with the system. Hence, we hypothesize that satisfaction with gamified activity positively influences perceived learning performance with the system.

D. Perceived Learning Performance

Perceived learning performance is an important dimension for students' education as behaviourally engaged students

achieve higher performance and participation than disengaged students. According to [7], gamers are more willing to continue in a behaviour that has an aspect of satisfaction because satisfaction is an essential source of value to them. This study defines learning engagement as "the displayed student behaviours of engagement that are associated with a student's effort towards learning and the learning process, for a single task or their overall learning experience" [2]. We can observe these behaviours to infer students' learning outcomes of the course materials or quizzes with the gamified IS or their involvement and participation level [15]. Thus, perceived learning occurs when the student is fascinated with the IS and derive course satisfaction and sustained attention and interest from the system.

As espoused in the literature, [23] proposed that the use of a gamified system is predictable when the user's interest aligns with the developer or instructor, and the gamified system is meaningfully engaged through motivational affordances (goal satisfaction, incentives, competition and rewards) invoked by the game elements. To this end, satisfaction fosters perceived learning performance and motivation for users to continue using the system and provide a positive view of HCI [32].

IV. METHODOLOGY

This study adopts a survey method to test the research model by empirically collecting data from students' users of the gamified system. Through path analysis, we analyzed the relationship between the variables (information quality, course satisfaction and perceived learning performance) and statistically tested their significance using the structural equation model [1]. For the early stages of developing theories, [3] suggest the use of partial least squares (PLS).

A. Measurement Items

Aside from the demographic data (age, gender, level of study), which are consistent with previous studies of gamification research, the study collected four categories of variables. First, information quality, which captures accuracy, completeness, format, and currency, were all adopted from [34]. To assess students' perceived learning in gamified systems, items from [42] were adapted, and course satisfaction items were adapted from [16]. The items for website and user characteristics were adopted from [17]; social characteristics were adopted from [30], task characteristics were adapted from [19]. Additionally, all the items were measured on a 7-point Likert scale, ranging from "strongly disagree" to "strongly agree."

B. Data Collection and Analysis

We collected data from undergraduate university students who are users of Kahoot[1], a gamified interactive application which contains game design elements. The application already has designed courses, for example, research methods, introduction to nursing, and project management quizzes. However, instructors can customize their courses for their student's benefits. The Kahoot application has a user base of over 30 million, and students receive points, badges, and leaderboards according to their contribution and completion of activities [9]. Using Kahoot to augment classroom practices opens the opportunity for students to learn with more pleasure, accumulate knowledge at freewill, and improve communication skills.

The study identified three programs in a higher education institution in Ghana, which use gamification to facilitate classroom teaching and learning. As such, an online questionnaire survey was designed and circulated to the students to share their experiences with the Kahoot. From an anticipated 216 students, the survey ended with 139 responses, representing a 64 percent response rate. The first-year students did not take part in the survey because they were new and yet to experience the gamified system. Table 2 is a summary of the demographic data of the respondents.

TABLE II. RESPONDENTS DEMOGRAPHIC DETAILS

Category	**Frequency**		
Gender	No.	%	*Total*
Male	52	37.4	
Female	87	62.6	*139*
Age			
17-20	36	25.9	
21-23	53	38.1	
24-27	31	22.3	
28 and above	19	13.7	*139*
Level of study			
Year two	46	33.1	
Year three	66	47.5	
Year four	27	19.4	*139*

V. RESULTS

Assessment of the research model followed a two-stage approach: (1) assessment of the measurement model for reliability and validity measures and (2) examining the structural model and hypothesis [6].

A. Measurement Model

Internal consistency, convergent, and divergent validity are employed to assess the properties of the instrument items. Similarly, Cronbach's alpha and composite reliability are used in examining construct validity. According to [41], an acceptable internal consistency and item loadings must exceed 0.7. From our study, all the reliability scores ranged from 0.81 to 0.92, which indicates good construct reliability.

Additionally, the average variance extracted (AVE) (above the minimum of 0.5) supported the adequacy of the internal consistency of all the constructs [41]. As shown in Table 4, the AVE of each construct is higher than the constructs correlations indicating the discriminant validity of the constructs. Using SmartPLS, we conducted a confirmatory factor analysis to assess convergent validity. The results reveal that the item loadings exceeded the recommended threshold of 0.7, ensuring statistical

[1] https://kahoot.com

significance (see Table 3 for loading and indicator reliability).

TABLE III. MEASUREMENT MODEL

Completeness (α = 0.80)	
The gamified application (Kahoot) provide me with a complete set of information	**0.83**
The gamified application (Kahoot) produces comprehensive information	**0.90**
The gamified application (Kahoot) provides me with all the information I need	**0.88**
Format (α = 0.79)	
The information provided by Gamified application (Kahoot) is well-formatted	**0.81**
The information provided by Gamified application (Kahoot) is well laid out	**0.92**
The information provided by Gamified application (Kahoot) is clearly presented on the screen	**0.84**
Accuracy (α = 0.84)	**0.77**
Gamified application (Kahoot) produces correct information	**0.81**
There are few errors in the information I obtain from the Gamified application (Kahoot)	**0.88**
The information provided by the gamified application (Kahoot) is accurate	
Currency (α = 0.81)	**0.92**
Gamified application (Kahoot) provides me with the most recent information	**0.81**
Gamified application (Kahoot) produces the most current information	**0.90**
The information from the gamified application (Kahoot) is always up to date	
Information Quality (α = 0.86)	**0.87**
Overall, I would give the information from the gamified application (Kahoot) high marks	
Overall, I would give the information provided by the gamified application (Kahoot) a high rating in terms of quality	**0.83**
In general, the gamified application (Kahoot) provides me with high-quality information	**0.84**
Course Satisfaction (α = 0.91)	
How helpful were the assignments and quizzes on the gamified application (Kahoot) to your understanding of the course material?	**0.91**
The speed with which the gamified application (Kahoot) presented the course material and quizzes were just about right	**0.84**
Overall, the information I get from the gamified application (Kahoot) is very satisfying	**0.90**
I am very satisfied with the information I receive from the gamified application (Kahoot)	**0.88**
Perceived Learning Performance (α = 0.89)	**0.87**
The gamified application (Kahoot) increased understanding of the basic concept in the course	**0.88**
The gamified application (Kahoot) facilitated additional reading and some self-thinking	**0.91**
The gamified application (Kahoot) increased my confidence in expressing ideas	**0.78**
Website Characteristics (α = 0.75)	**0.81**
The gamified application (Kahoot) allows me to interact with it to receive tailored information	**0.82**
The gamified application (Kahoot) has interactive features, which help me accomplish my learning task	**0.79**
I can interact with the gamified application (Kahoot) in order to get information tailored to my specific needs	**0.80**
User Characteristics (α = 0.84)	**0.89**
I feel happy when I use the gamified application (Kahoot) because it meets my skills	**0.74**
Learning to operate the gamified application (Kahoot) is easy for me	**0.79**
The gamified application (Kahoot) labels are easy to use	**0.81**
Social Characteristics (α = 0.72)	**0.91**
I feel sociable when I use the gamified application (Kahoot)	**0.80**
Colleagues who influence my behaviour use the gamified application (Kahoot) and think I should use	
Colleagues around me think the use of the gamified application (Kahoot) is good for me	**0.79**
Task Characteristics (α = 0.80)	**0.90**
The gamified application (Kahoot) provides me with useful feedback	**0.78**
The gamified application (Kahoot) rewards my effort with points or scores	**0.81**
The task assigned in the gamified application (Kahoot) is interactive	**0.76**

α – Cronbach's alpha

B. Structural Model Testing

We estimate the research model by conducting a SmartPLS test with a bootstrapping process to highlight the path coefficient and the R^2 value. The path coefficient and the R^2 value together explain how the hypothesized model is supported by the data. As shown in Figure 2, the structural model explains 48% of the variance in student perceived learning performance with gamified systems. Likewise, the model reported for a significant amount of variance in student enjoyment toward gamified systems ($R^2 = 0.45$).

Further, the results show that currency ($\beta = 0.282$, $p<0.05$), completeness ($\beta = 0.271$, $p<0.01$) and accuracy ($\beta = 0.491$, $p<0.01$) all positively influenced information quality. However, the impact of format on information yielded non-significant results ($\beta = - 0.049$, $p<0.05$). The relationship between information quality and course satisfaction showed positive results ($\beta = 0.65$, $p<0.001$), while and satisfaction positively influence students learning ($\beta = 0.51$, $p<0.05$). All the contextual factors exhibited positive relationship with information quality (Website $\beta = 0.456$, $p<0.001$), User ($\beta = 0.351$, $p<0.001$), Social ($\beta = 0.403$, $p<0.001$) and Task ($\beta = 0.501$, $p<0.05$) characteristics. Additionally, we observed the effect size (f^2) of the two dimensions. We found that contextual information quality had an effect size of 0.312, which is greater than representational information quality (0.121).

VI. DISCUSSION

The focus of this study is to examine how the quality of information produced on gamification platforms enhances student learning. The study proposed a research model depicting acceptance of the relationship between information quality, course satisfaction, and perceived learning with the IS. In general, our study (except format) found evidence that supports the overall validity of the model. Namely, currency, accuracy, and completeness positively affected information quality delivered to the

students on the gamified IS. Also, in terms of drivers for student perceived learning, this study focused on information quality and the differentiation in analysis between representational information quality and contextual information quality. Thus, information quality positively affected students' satisfaction with using gamified IS. Students' course satisfaction in turn positively affected their perceived learning performance with the gamification system. This further explains the IS success model that less satisfied students with the gamified information will manifest low access and interest in the use of the gamified IS [24].

Further, the findings suggest that the dimensions of information quality satisfy the primary needs of the learner, which in turn increases satisfaction, which is a determining factor of perceived learning with the gamification system. For instance, information characteristics account for 64% of the variance of information quality. Judging from this,

TABLE IV. RELIABILITY, DISCRIMINANT VALIDITY, AND CORRELATION

	CR	AVE	1	2	3	4	5	6	7	8	9	10	11
COM	0.87	0.76	**0.91**										
FOR	0.83	0.68	0.51	**0.89**									
ACC	0.92	0.87	0.24	0.45	**0.84**								
CUR	0.88	0.73	0.33	0.32	0.38	**0.90**							
INQ	0.91	0.72	0.48	0.51	0.41	0.48	**0.88**						
CS	0.92	0.79	0.51	0.48	0.34	0.39	0.51	**0.84**					
PL	0.90	0.83	0.52	0.41	0.32	0.56	0.49	0.66	**0.85**				
WEB	0.82	0.62	0.26	0.36	0.51	0.28	0.29	0.32	0.40	**0.79**			
USE	0.81	0.60	0.19	0.19	0.26	0.38	0.13	0.09	0.41	0.38	**0.80**		
SOC	0.86	0.67	0.37	0.33	0.10	0.08	0.29	0.24	0.11	0.37	0.45	**0.71**	
TAS	0.92	0.74	0.42	0.28	0.25	0.41	0.32	0.56	0.46	0.21	0.33	0.38	**0.83**

Note: CR – Composite reliability; AVE – Average variance extracted; the diagonals represent the square root of the AVE of the constructs; COM – Completeness; FOR – Format; ACC – Accuracy; CUR – Currency; INQ – Information quality; CS – Course Satisfaction; PL – Perceived Learning; WEB – "Website Characteristics; USER – User Characteristics; SOC – Social Characteristics; TAS – Task Characteristics

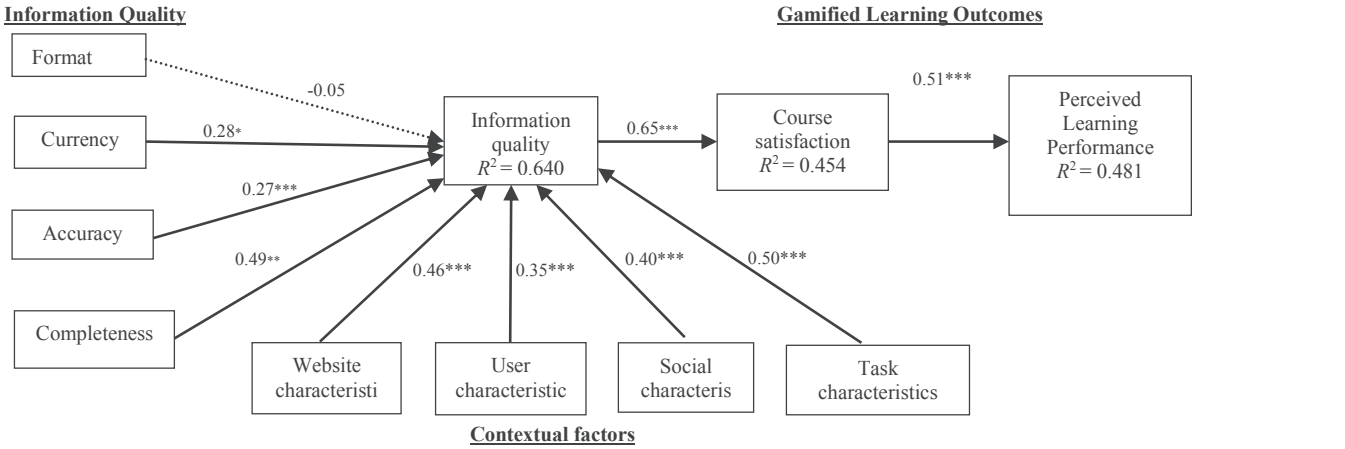

Figure 2. Predictive Model Results

we argue that gamification should not be viewed only from the perspective of affordances such as points, badges, and leaderboards that rewards the learner. Thus, the gamified information that is available to the learner should be current, accurate, and complete, which are antecedent to information quality.

We also found that format was not an essential dimension of information quality to students on the gamified system. Frequently, decisions on how well-formatted or laid out the information are not essential under quiz conditions as to the relevance, accuracy, and completeness of the information. Other systems may

experience the relative effect of format, especially those that facilitate design and marketing campaigns.

Based on our findings, we dispel the notion that gamification is mainly about adding game elements to systems to enhance learning. This study shows that gamification in education may not be successful in promoting students learning if the designed system ignores the relevance, sufficiency, and accuracy of the information and focus mainly on the hedonic aspect. As discussed earlier, we classified the four characteristics as proposed by [11] as the contextual factors that may influence information quality in a gamified system. From the study, we found a positive association among all the construct's characteristics. Similar to [40], we found out that students who search the gamified website's information for course materials are more likely to reflect the intrinsic and the contextual categories of assessing information quality. Additionally, since the gamified (website) characteristics have many courses and designs, students' consideration of the type of information that will enhance their learning is impacted by the website or gamified characteristics. Thus, students' positive website characteristics are likely to lead to information quality search [5], which in turn may encourage frequent visits to the gamified system. Just like WC, TC played a crucial role in evaluating and influencing the quality of the information in a gamified system. Thus, students' task search on a gamified system becomes utilitarian and goal-oriented towards the syllabus for the semester. This means TC or orientation should lead to the quality of the information at their display. For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

VII. Implications for Higher Education

For the higher education institution or study targeted, we conclude that contextual factors (four characteristics) and the role of contextual and representational information quality have an impact on information and user satisfaction in the gamified information systems. Our study reveals that the effectiveness drives student information satisfaction within the gamified IS and how well the information is used in the classroom environment to engage students learning activities. Thus, the acceptance of gamification in education requires an effort on how well the information fits teaching and learning process, in as much as we focus on end-user and resistance to gamification as posited by prior research [24].

Our study implies that instructors who deploy gamification as a learning tool should not always focus on increasing the hedonic value to engage users at the detriment of integrating games in learning. Our study proves that the aim of gamifying a course activity should be to increase knowledge or satisfy the student knowledge acquisition by providing information satisfaction current to the syllabus in an exciting way. To this end, our theoretical model may help researchers explore and better explain the features of systems and the information it generates to users to make a better prediction across contexts, especially the concept of information quality of games. Further, our model would be essential to researchers in investigating if there are core tenants of gamification systems characteristics that apply to a wide range of perceived learning or motivational systems. Additionally, our findings have important implications for higher education institutions. Higher Educational institutions are increasing their focus on games in education and online learning. With the increasing use of game design elements, an improved and effective student-side digital learning strategies are essential to leveraging gamification technologies for enhanced learning performance. The higher education institution in our study is a leading Ghanaian university, and our findings have implications for online learning strategies across Ghanaian higher education institutions.

Moreover, practitioners could link how individuals process information in their context environment [11] to develop and anticipate likely response behaviours towards a gamified learning system and better understand how they process information in the context of user, social, website and task characteristics. Also, the significant assessed factors can help educators better design gamification systems that focus on student characteristics that influence satisfaction and learning behaviours. By differentiating and categorizing the various dimension of information quality, we can conclude that contextual factors and contextual information are vital in explaining student's enjoyment with gamified systems which leads to leaning performance. To educationist, designing the gamified learning environment, this means the information provided to the students should align with the educational elements. Thus, based on our study higher education institutions can implement appropriate measures to increase student perceived learning performance by differentiating the cultural factors that impact information quality from the representational and contextual information quality.

VIII. Limitations and Future Research

This study has its limitations, despite the contributions to understanding online student satisfaction through games. First, our study was conducted in a higher education context in West Africa. Thus, a generalisation of results to some extent is limited. Future research may approach this study from an organisational perspective, regional balance, or domains other than education.

Second, the respondents were undergraduate students and current users of the gamification system (Kahoot), so the preadoption behaviours and results are not reported to further our understanding of the condition. Future research may generalise base on Kahoot's application and no other gamified systems for accurate reporting. Third, our study is limited by the selections of dimensions of contextual factors and contextual and representation

information quality. This limitation is based on our intensive literature analysis on information quality; even though some additional dimensions may be useful, the selected were based on the appropriateness to gamification research. Notwithstanding, the R^2 proved highly significant in explaining students' enjoyment with the gamified information.

Finally, aside from the limitations, this study provides support for the quality experience of students on gamification platforms. To better engage students' acquisition of knowledge through gamification, this study expands our understanding of information quality and its antecedents, satisfaction, and the composite nature of student online learning.

IX. Conclusion

Gamified information systems are increasingly being used in different domains and disciplines. Instructors and students in higher education have started to realize the potentials of accepting gamification systems such as Kahoot in enhancing classroom activities. However, little is known about the information and systems antecedents that can be prioritized on gamified platforms to enhance user satisfaction in learning. Therefore, based on our study, we have provided grounds to classify information quality on contextual factors, representational, and contextual information quality in a gamified learning environment. This study increases our knowledge about Kahoot in classrooms by exploring how mobile game learning applications can be used by instructors to enhance students and increase their motivation to learn beyond the classroom. We also demonstrated that it is not sufficient to make the application available to the students. The output of the IS has the potential to affect students' satisfaction and perceived learning performance. We, therefore, conclude that for educational institutions to implement gamified systems and other learning management systems, the differences among information quality dimensions and antecedents should be considered to provide countermeasures to mitigate the issue that arises and encourage use.

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