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Motivation in Gamified Social Media Learning: A Psychological Need Perspective

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ABSTRACT

With a high attrition rate among students in online learning, educators and researchers have introduced gamified social media learning platforms which allow students to share their experiences, co-create knowledge, and collaboratively learn about computing principles. However, only a few studies have examined learners' motivations, antecedents, and consequences on a gamified social learning platform. This study draws on the self-determination theory to test a proposed model for gamification users in computing education. Participants were undergraduate students who completed an online survey during the semester on a course design project. This course aims to prepare students to undertake a significant piece of individual work on a design project and appreciate the appropriate techniques in managing information technology projects. Interestingly, the study found a non-significant relationship between game rewards and how they improve competence. The results expand our understanding of pedagogical strategies and innovation open to education institutions.

Keywords: Gamified social media, Gamification, Student engagement, Self-determination theory, Motivation

1. INTRODUCTION

Many educational institutions and educators have sought different ways to use technology and social media platforms to include real-world issues in their teaching in order to enhance learning and engagement. Game design elements and video games have been proposed to be able to accomplish these goals. After all, games are a fundamental part of the human experience and play an important role in the lives of both children and adults. To this end, there has been increased awareness regarding the "potential of computer games in education, including growing interest in their application in higher education" (Whitton, 2009). Several studies have focused on identifying the factors that make games persuasive and motivating. One promising idea for enhancing and motivating students in social learning environments is "gamification, the use of the game design in a non-game context" (Morschheuser et al., 2017).

However, studies focusing on human needs have proposed that needs stipulate the necessary conditions for psychological well-being and that one's satisfaction is associated with the most effective functioning of human beings (Ryan and Deci, 2000). Our research draws on the self-determination theory (SDT) on gamification systems, which proposes that students' psychological needs influence their use of gamified learning systems, to the extent that the system provides affordances (rewards and competition) that satisfy their needs. Unlike other theories, this theory is premised on the situational motivation factors that explain why people use technology to accomplish tasks personally and voluntarily (Ofofu-Ampong and Boateng, 2020). On a personal level, inner motivation (initiated by innate psychology) is critical in energizing student's behaviors (Ryan and Deci, 2000).

The relevance of SDT to this study stems from the personal and voluntary use of gamified systems and the general ubiquitous use of technology. Although several studies on

gamification have included psychological needs in education, others have identified gamification affordances (Buckley and Doyle, 2017). It should be noted that most previous studies have focused on gamified learning systems (social media learning platforms through gameplay) and other mobile game applications. Different systems produce different salient affordances which render the assessment of gamification success pessimistic and often equivocal (Suh, Wagner, and Liu, 2018). For example, user engagement created by game affordances, such as leader boards, points, and badges, has been identified across studies on specific gamified learning systems, with some being different (different levels of abstraction) and others being similar (components or build-up of others). Importantly, the lack of theory has limited our understanding of how some gamified systems motivate and engage students more than other education systems. Few attempts have been made to theorize a relationship between game design elements and psychological needs in explaining gamification in computing education. To this end, we attempt to address the following question in this study:

How do game design elements support and enhance students' basic psychological needs in gamified social media learning?

This question is considered vital in light of SDT because not all students excel at the cognitive levels that are a fundamental focus for schools. However, schools should provide support for development and create conditions that can help improve the students' online learning adaptive capabilities and are harmless to their learning needs. SDT assumes that support for basic psychological needs nurtures the well-being of learners, which is demonstrated across age, culture, ethnicity, and level of study (Ryan and Deci, 2020). We employ SDT to understand the basic psychological needs support of users in a learning environment. Given the diversity of learners, we examine game design elements' central role in supporting autonomous, competence, and relatedness behaviors in fostering inclusive gamified learning environments.

By identifying psychological needs and gamification affordances, the main achievements, including contributions to the computing education field, can be summarised as follows. First, we provide a detailed general analysis for gamification research and on specific gamified social media platforms by identifying the motivation behind the use of specific game design elements. Second, from the viewpoint of needs, it provides design guidelines (design science) that can help design gamification elements that are worth engaging users. To better understand and predict student engagement with a gamified system, we employed SDT and developed a theoretical model for the study.

2. THEORETICAL BACKGROUND

2.1 Gamification in Computing Education

Gamification is a relatively new term but not a new concept. It emerged in 2000 in the digital sphere and became a popular field of study in 2010. Because of the hype and popularity of games in learning environments and learning management systems, the widespread practice of adding game elements has attracted the attention of educators and instructors (van Roy and Zaman, 2019). Gamification has gradually started to be rooted

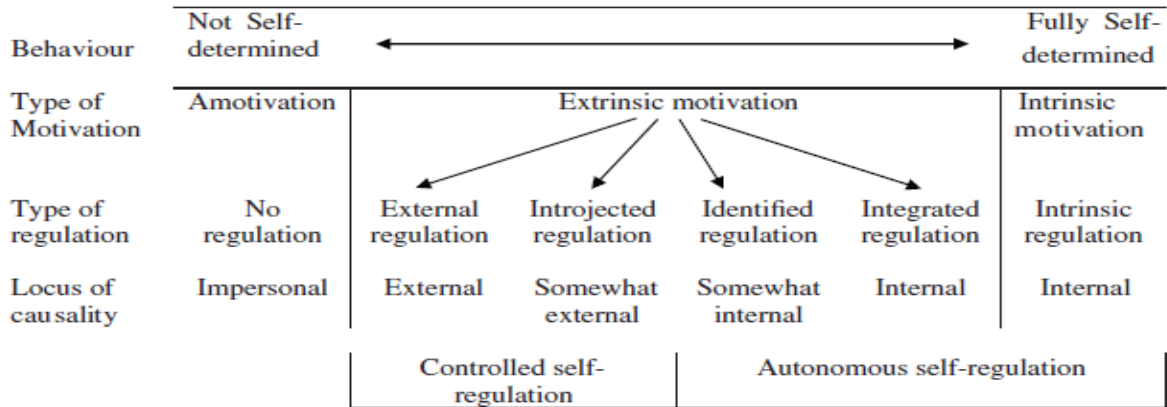
in the minds of educators, especially in higher education and computing education, since the main goal of computing education in higher education is to prepare the students for future learning. Thus, the objective of this study stems from the fact that students can be prepared to learn about research methods, statistics, and computing education by engaging them with game design elements and tasks that draw their attention to sampling, research, and computing on a socially motivated learning platform. This is not surprising given that the global gamification market is projected to grow to \$40 billion by 2024 from its current value of \$6.8 billion in 2018 (Report Linker, 2019).

Although gamified social media platforms require game design elements to function, the type of game elements needed depends on the discipline or context of use. In computing education, game design elements are categorized into mechanics and objects. On the one hand, game mechanics represent the rules that govern the different interactions with an object, for example, *rules regarding when and how to reward students*. On the other hand, objects are the scripts, stories, images, or characters displayed in the application. Some scholars have represented gamification in the form of points, badges, and leader boards (PBLs). For example, in a review of gamification, Morschheuser et al. (2017) identified PBLs as three dominant game elements in crowdsourcing. Similar results were found by Seaborn and Fels (2015) in another review of gamification in theory and action. In recent years, gamification has been applied in different disciplines, such as marketing, education, and information systems (IS), to enhance interaction and engage, motivate, and influence behaviors and attitudes towards the desired outcome (Wiggins, 2016). However, in this study on computing research education, we are concerned with how students understand a computing course and how they combine that understanding with fun (game elements) and productivity to make it easier.

2.2 Psychological Needs in the Context of Gamification

One of the significant features of gamification of user-generated content is that the gamified system becomes a "social learning platform" as students engage in discussions to create content (Kaplan and Haenlein, 2010). Users of gamification enjoy a high level of flexibility in determining which game design elements (e.g., rewards or recognition) motivate them, when to be notified for learning, when and how to achieve goals, what to create and share, and what assignment to read or undertake. Before the emergence of digital games in learning, the content of most learning management systems was designed and created by system administrators or instructors and was, thus, not social. At that point, most users were unable to create discussion forums, comment, or add content to the platform, and they were primarily receivers of learning content (passive). Nowadays, gamification users in higher education can create information and personalize their learning patterns or platforms to their level of engagement. To this end, SDT is arguably a salient aspect of game design elements in learning.

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 [sic] in a *self-determining* fashion" (Deci and Ryan, 2000). Humans are, by nature, inclined to grow and develop psychological elements that unify a sense of the self and integrate them into the larger



society. Individual tendencies can be affected by an internal or external locus of control, which is the need (psychological) for autonomy, competence, and social relatedness. Deci and Ryan (2000, p. 229) 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.

Figure 1 shows a spectrum of motivation and how the component relates to motivating an individual. SDT in this regard explains how external stimuli affect an individual’s intrinsic motivation.

The need for *autonomy* is an individual psychological desire to make choices and take control over one’s own life. It posits that one needs to act authentically in a way that is consistent with one’s true self (free choices) rather than acting voluntarily or by volition (Deci and Ryan, 2000). 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 and 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 and accumulate their interactions with a system or environment. The need for *relatedness* describes the social interactions, connections, belongingness, and deep concern regarding others through caring (Deci and Ryan, 2002). This innate, individual, psychological need involves receiving and providing care or love and the need for a mutual relationship (like-minded) and experiences depending on the interaction with others (Richter, Raban, and Rafaei, 2015).

2.3 Selected Studies that Apply Self-Determination in Gamified Learning

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 in student 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 average level. The game elements used in that study were badges and rankings. In another study, De-Marcos et al. (2014) reported positive attitudes 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 experience 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.

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

3. RESEARCH MODEL

To improve learning outcomes and engage students, gamification exploits game design elements in information systems. Game design elements are fundamental features of gamification systems (Werbach and Hunter, 2012). In the context of gamification and games, several game elements have been identified to motivate students. However, there are still no universally accepted game design elements. Therefore, several scholars have called for the assembly of recurring game elements in education. For example, Strmečki, Bernik, and Radošević (2015) identified nine game elements (badges, customization, points, challenges, levels, feedback, quests, leader boards, and freedom to fail) appropriate for use in an e-

learning application to improve student performance. In addition, Villagrasa et al. (2014) identified avatars, points, badges, and quests as crucial game elements that motivate and engage students in computer animation programs. Several scholars have found that the elements provided the students with an opportunity to collaborate, receive feedback on tasks, and compete in a social environment. Among the 15 game elements identified by Werbach and Hunter (2012), PBLs were classified as the dominant game design elements, hence the name “PBL triad.”

To this end, game design elements can be identified through gamification or added from the build-up stage. This means that the use or application of gamification elements is subjective even though there are several parallels of game elements. In this study, we focus on the gamified e-learning application. Hence, we will not compile existing game elements but will instead identify the gamified e-learning application elements. After an extensive review (Dellos, 2015; Wang, 2015), we identified points, leader boards, badges, and performance graphs as the main game design elements within the gamified learning application. We focused on these four game elements because of the clear visibility to players and the direct relationship that we expect to have with our theoretical perspective. Points serve as a reward and help measure players’ in-game behaviors by providing quick feedback (Sailer et al., 2017). They are mostly awarded upon the successful completion of an assignment. Badges are a visual representation of accomplishments, and leader boards are rankings based on points or scores of one’s achievement. It should be noted that leader boards may create social pressure among students when there is intense competition for the top spot, and this increases system engagement (Burguillo, 2010). Unlike leader boards, performance graphs indicate student performance over time. Students improve when they see their performance graph displayed over a period of time.

Given the game elements identified, we assume that the need for autonomy, competence, and relatedness is associated with PBLs (see Figure 2). In the context of gamification application, PBL is referred to as a reward system or a form of competition. Thus, rewards are given to students as a payoff for completing assignments or tasks, and they stimulate students to strive to attain high points, reach the top spot (leader boards),

and/or achieve trophies (badges) (Hense et al., 2014). 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) which can be directly associated with students’ actions and behaviors. At the same time, badges and leader boards measure students’ actions over a given amount of time and provide cumulative feedback (Rigby and Ryan, 2011).

A gamified application 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, and Przybylski, 2006) and what the users intend (choice) to do with PBLs in a gamified application (Werbach and Hunter, 2012), resulting in increased autonomy perception.

In this study, we posit that relationship formation, self-presentation, interactivity, and sharing of learning materials and content can help learners realize the need for autonomy and enable them to choose what to present freely. Besides, they provide learners with practice quizzes to engage in, with learning content to choose and share, with the ability to listen to or read whatever they choose, and with the ability to freely interact with their online gamified environment (Karahanna et al., 2018). For example, gamified applications provide learners with self-presentation, relationship building (communicating with similar learners during a course), sharing of learning content, and connection with family (family fun), which allow 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 affiliation or program of study).

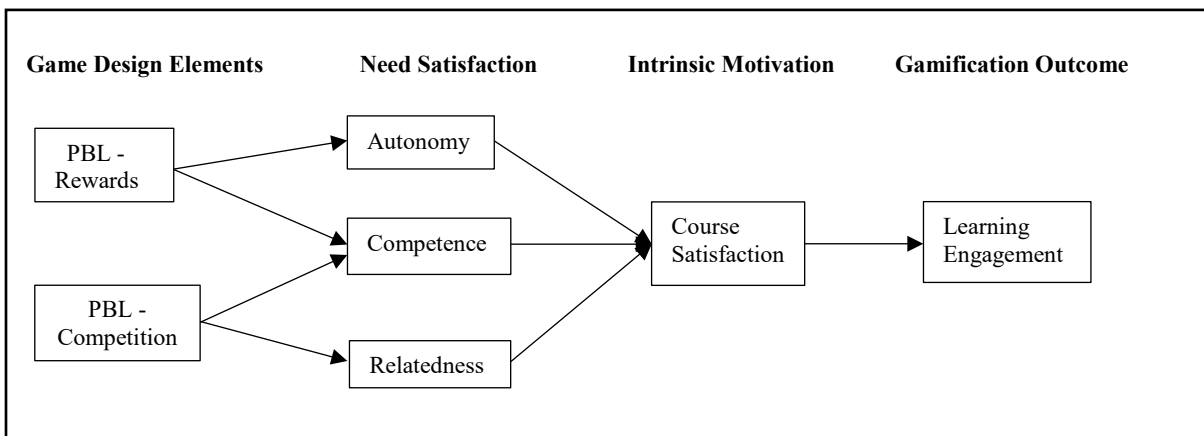


Figure 2. Research Model

Importantly, game elements that afford interactivity and self-presentation allow learners to choose avatars, customize their profile display, work hard or build more points if they want to be ranked higher on the leader board, interact with co-learners, and participate in learning behaviors that reflect their true identity without being perturbed about norms that constrain their behaviors as in real-life contexts (Kaplan and Haenlein, 2010). Distance learning and self-study affordances, for example, on a gamified platform allow learners to choose “competitive ranked courses or groups” or challenging quizzes that they can join or solve. This discussion leads to the following hypothesis:

H1:PBLs as rewards are positively associated with autonomy need satisfaction in a gamification application.

Several game design elements are perceived as a motivational driver 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, and Grieve, 2020). Therefore, students who are 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 realize the need for competence by enabling them to hone and apply their skills. This is achieved by participating in class quizzes, engaging in platform discussions, responding to colleagues’ questions or providing feedback, competing for the top-most game design elements (e.g., points, badges, or leader boards), or collaborating to create learning content for the class (Majchrzak and Malhotra, 2013). While the subsequent paragraphs of this section elaborate on the hypotheses for the study, Figure 2 shows the conceptual framework of the theory used for this study.

In a gamification learning application, learners can gain further insights and apply their knowledge to a topic by creating content specific to their course of study or engaging in class quizzes or discussions mediated by their course instructor or the administrator of the platform discussion. In a gamified environment, where competition is salient, challenges can emerge among players, which is rare in real life, hence providing the learners with a unique, enjoyable learning opportunity to demonstrate their efficacy and their challenge (Karahanna et al., 2018). Gamification application platforms, for example, provide learners with an opportunity to complete tasks or semester courses within a time frame. They allow them to experience competence through quizzes and to solve practical questions via video-based learning to demonstrate their expertise in the course (Wang and Tahir, 2020). Such an application supports the need for collaboration among learners (discussing a research topic, satisfying colleagues’ needs, or class groupings to conquer challenges with game points), which in turn demonstrates their collaborative ability in an online learning context, thus satisfying their competence needs (Kane et al., 2014). This discussion leads to the following hypothesis:

H2:PBLs as rewards are positively associated with competence need satisfaction in a gamification application.

We also expect PBLs 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 leader board and receive a trophy (badge). Therefore, the leader board is considered fundamental for displaying the results (accumulation of points) and revealing the front-runners of the class. 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 individuals’ skill endowment in games and propels one to achieve more in a competitive environment. Such interaction may allow a player to internalize the competencies of others (Ryan and Deci, 2000), thereby improving their position within a gamified system. Hence, the following hypothesis is made:

H3:PBLs as competition are positively associated with competence need satisfaction in a gamification application.

We also argue that a set of game design elements (PBLs) can help learners realize the need for social relatedness by opening up broader social connections in a gamified environment (Majchrzak and Malhotra, 2013). Gamified application achieves this by connecting players with a collective “aim” online status, enabling the participation of learners in a group activity and indicating players that are available for learning interaction; some can be online but not in an available learning mode. It also helps learners know which course their colleagues are completing or partaking in most, with whom they are collaborating within a course, and their reaction to a post and/or comment in a social setting (Majchrzak and 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 leader board rankings; thus, users can see the best performing learners on the leader board with whom they have no mutual connection.

Gamification systems allow players to join groups to accomplish tasks or assignments, form relationships, make new friends, share their adventures, and interact with players they might never meet in person. 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, responses to others, self-presentation, and communication, which yield a feeling of relatedness due to increased familiarity (constant interaction) (Karahanna et al., 2018). For example, teachers can engage students outside the classroom using challenge design elements. Learners can also host a live game over video which 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 learners of a course. This discussion leads to the following hypothesis:

H4: PBLs as competition are positively associated with relatedness (social) need satisfaction in a gamification application.

From the psychological need perspective, individual self-determination or motivation is mediated when basic needs are satisfied (Deci and Ryan, 2008). 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. Several empirical studies have supported the mediating effect of user satisfaction. For example, Shen, Liu, and Wang (2013) found that the perceived online need satisfaction of elementary school students 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. Hence, the following hypothesis is made:

H5: Need satisfaction (autonomy, competence, and relatedness) positively predicts intrinsic motivation/course satisfaction in a gamification application.

SDT assumes that self-determined behaviors lead to positive outcomes and that non-self-determined behaviors result in negative outcomes. Several studies have posited that students with higher self-determination than others reported positive learning engagement and attitudes and achieved better learning outcomes (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). Given that game research has shown that gamifying activities are motivating and enjoyable, self-determination/intrinsic motivation is a central factor in determining the engagement of students 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 made:

H6: Course satisfaction positively influences learning engagement (learning outcome) with a gamification application.

4. METHODS

An online survey was conducted to empirically test our research model. This survey, which takes approximately 16 minutes to complete, was intended for gamified users (students) in higher education institutions (HEIs). The questions included all the variables (game design elements, need satisfaction, intrinsic motivation, and gamification outcome) essential in the model. Using a structural equation model (path analysis), the relationship between the variables was tested to identify their statistical significance. Consequently, partial least squares

regression was chosen in this study because of its appropriateness for theory development at early stages (Thompson, Barclay, and Higgins, 1995).

4.1 Measures

Aside from questions regarding demographic information, the study adopted four categories of variables measured on a 7-point Likert scale. Items of game design elements evoked by game dynamics (rewards and competition) were inspired by van Roy and Zaman's (2019) scale. To test for need satisfaction, we adopted items from Standage, Duda, and Ntoumanis' (2005) scale on autonomy and relatedness, as well as from the competence scale of Jang et al. (2009). Each of the variables consisted of three items. The intrinsic motivation scale developed by Standage, Duda, and Ntoumanis (2005) was adopted to measure self-determination/motivation, whereas the items for engagement were adopted from Standage, Duda, and Ntoumanis (2005) and Brockmyer et al. (2009). In light of recent studies on PBL and human interaction, we used gender, age, and level of study as our control variables (Hartmann and Klimmt, 2006).

4.2 Data Collection

A total of 124 undergraduate students from a large university in Ghana participated in this study, all of whom completed the online survey during a computing education course (Computer Science & Information Technology Design Project). An invitation to participate in the online survey was sent over the class' WhatsApp groups by a course representative, and the students were invited to participate on a voluntary basis. Out of a total of 139 students, 130 completed and returned the survey, yielding a 93.5% response rate. Data screening and verification were performed to avoid any form of missing data, errors, or outliers by employing a normal probability plot and whisker plots (Kline, 2011). Verification and screening revealed that more than 5% of the data were missing, which resulted in deleting 6 of the responses, hence yielding a sample of 124, with an 89.2% response rate.

The main goal of the CSIT course is to prepare students to undertake a significant piece of individual work on a design project and also help them appreciate the appropriate techniques in the management of IT projects. Working in groups of five, the students were supposed to investigate a relevant topic that has a computer-based solution by researching the literature, evaluating possible solutions, and selecting the most appropriate solution. All discussions (especially on the stages of the system development life cycle) among the students were hosted on a gamified platform which helped the instructor support, monitor, and guide the learning process. In the middle of the semester, the students were supposed to undertake quizzes on the platform to assess their practical problem-solving and collaboration skills as well as the development of flexible knowledge and intrinsic motivation, since the CSIT course used a problem-based learning method. At the end of this online-based learning approach, the instructor helped the students in the implementation of an IT application project. Some of the projects that the students carried out included a transport management system for a local cooperative transport union, a welfare management system, a leave management system, a theft alarm system, and a garbage recycling system.

Generally, students in HEIs are often considered leading internet users. However, the internet is not the only technology that HEIs have adopted to facilitate learning and teaching. With gamification, game-based learning, and other technologies, students now have a variety of motivational and entertainment system options available on their mobile phones to engage their learning skills. In general, students use game-based learning mobile applications in a resource context. This is because such institutions critically need to utilize gamification to ease the resource constraints in the classroom, and yet they receive the least research attention. Thus, university students are considered potential users of gamification and a suitable target for this research. Game-based learning mobile applications are adopted in the systematic learning of research methods, such as design project practices, knowledge sharing, collaboration, and engagement between students and between students and instructors. On successfully completing tasks, students receive points, badges, and scores as acknowledgements visible to other students on the leader boards (to encourage challenge and add social aspects to badges and points). With more than 30 million users, gamified learning applications have been globally accepted and recognized in online learning as the most associated with gamification as compared to other applications, such as Quizizz, Edmodo, and Socrative (Dellos, 2015).

5. RESULTS

Using the structural equation model, we tested the hypothesized SDT model (Jang et al., 2009). We followed the two-stage analytical procedure proposed by Anderson and Gerbing (1988). We first tested the measurement model for validity and reliability and then examined the structural model and its related latent variables.

Table 1 shows the descriptive representation of the participants. From the table, most of the respondents were male (63.4%), which was not surprising since the department (i.e., the Computer Science and Information Technology Department, CSIT) that has adopted gamification for teaching and learning is male-dominated. Moreover, 58% of the students were between 16 and 23 years old, and 28.2% were between 24 and 27 years old. Respondents aged 28 and above represented 5.7% of the study population. At the time of data collection, freshmen had not even commenced their studies, not to mention the use of gamified learning applications for teaching and learning. Second-year students represented 38.7% of the study population, third-year students represented half of the study population (50%), and fourth-year students represented 11.3% of the study population.

5.1 Assessment of the Measurement Model

The first call for examination was the factor loading. All loadings were above 0.70 except for item 2 on the competition scale (0.62). To validate the measured model, reliability and validity analyses were performed (Tables 2 and 3).

Demographic	Category	Frequency	Percentage
Gender	Female	38	30.6%
	Male	86	69.4%
Age	16–19	19	15.3%
	20–23	53	42.7%
	24–27	35	28.2%
	28 and above	7	5.7%
	No response	10	8.1%
Level of study	Second-year	48	38.7%
	Third-year	62	50.0%
	Fourth-year	14	11.3%

Table 1. Demographic Characteristics of the Respondents

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 the 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 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 gamified app (e.g. IT project management, 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 with the application.	0.26	0.35	0.18	0.71	0.29	0.50	-0.06	0.742
CPT2: I am satisfied with my performance on the gamified application.	0.22	0.42	0.26	0.76	0.41	0.14	0.20	
CPT3: After using the gamified application for a while now, I feel pretty competent.	0.34	0.45	0.30	0.81	0.30	0.03	0.16	
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.	0.33	0.36	0.19	0.19	0.92	0.00	0.31	0.895
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 as I spend time with them.	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 to learn on a gamified application.	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 studying for a very long time while using gamification.	0.09	0.41	0.41	0.26	0.18	0.09	0.89	
<i>Note: CMP, competition; REW, rewards; AUT, autonomy; CPT, competence; RLD, relatedness; CS, course satisfaction; ENG, engagement; α, Cronbach's alpha</i>								

Table 2. Cross Loadings and Indicator Reliability

	CR	AVE	1	2	3	4	5	6	7
CMP	0.83	0.56	0.75						
REW	0.90	0.70	0.39	0.84					
AUT	0.84	0.59	0.35	0.55	0.76				
CPT	0.88	0.71	0.43	0.32	0.38	0.84			
RLD	0.93	0.83	0.21	0.41	0.31	0.48	0.91		
CS	0.92	0.79	0.51	0.38	0.34	0.29	0.51	0.89	
ENG	0.94	0.83	0.62	0.48	0.52	0.56	0.49	0.66	0.91

Note: CR – composite reliability; AVE – average variance extracted. The diagonals represent the square root of the AVE of the constructs

Table 3. Discriminant Validity and Correlation

5.2 Structural Model Assessment

To test the structural model, both the coefficient of determination (R^2), which determines the amount of variance explained by the independent variable, and estimation of the path coefficient (loadings and significance), which indicates the significance level between a dependent and an independent variable, were assessed (Henseler, Ringle, and Sinkovics, 2009). Thus, to generate the t-statistics and significance level of the path coefficient, bootstrapping was used (SmartPLS). Table 4 shows that 35.9% of the students’ course satisfaction is explained by autonomy, competence, and relatedness, and the control variables by 65.2% of user engagement. In addition, 19.0% of the variance of autonomy is explained by rewards, 11.1% of the variance of competence is explained by competition and rewards, and 3.2% of the variance of relatedness is explained by competition.

Construct	R Square	R Square Adjusted
Autonomy	0.190	0.181
Competence	0.111	0.092
Course Satisfaction	0.359	0.338
Relatedness	0.032	0.022
Engagement	0.652	0.649

Table 4. R Squares

5.2.1 Common method variance. Harman’s single test factor was used to check for the potential problem of common method bias (CMV) (Chang, Van Witteloostuijn, and Eden, 2010). Without rotation, all the variables were loaded into an exploratory factor analysis. The results indicated that no single factor explains a disproportionate majority of the variance (i.e., over 50%), thus revealing multiple factors, with the first factor accounting for 23.21% of the total variance. The test results indicated that no “general” factor is significant in the data. Moreover, the correlation matrix was examined. The results revealed that CMV is an unlikely concern with our data because of the absence of a highly correlated variable in the matrix (Podsakoff et al., 2003).

5.2.2 Structural model results. It was found that the path coefficients between autonomy and course satisfaction ($\beta = 0.328, t = 1.980$), competition and competence ($\beta = 0.347, t = 2.680$), competition and relatedness ($\beta = 0.384, t = 2.686$), course satisfaction and engagement ($\beta = 0.812, t = 11.498$), relatedness and course satisfaction ($\beta = 0.289, t = 2.032$), and rewards and autonomy ($\beta = 0.560, t = 6.281$) were all significant at 0.05 or 0.01, offering support to H1, H3, H4, H5a, H5c, and H6 (see Table 5). However, the path coefficients between reward and competence ($\beta = 0.225, t = 1.778$) and competence and course satisfaction ($\beta = 0.171, t = 1.029$) were both non-significant, thereby rejecting H2 and H5b. The loadings also showed a strong inter-relationship among the construct’s items, with a minimum correlation of 0.70.

Hypothesis path	Original sample	Sample mean	Standard deviation	T-statistics	P-values
H1: Reward -> Autonomy	0.560	0.585	0.089	6.281	0.000
H2: Reward -> Competence	0.225	0.252	0.127	1.778	0.076
H3: Competition -> Competence	0.347	0.340	0.129	2.680	0.008
H4: Competition -> Relatedness	0.384	0.386	0.143	2.686	0.007
H5a: Autonomy -> Course satisfaction	0.328	0.364	0.166	1.980	0.048
H5b: Competence -> Course satisfaction	0.171	0.151	0.167	1.029	0.304
H5c: Relatedness -> Course satisfaction	0.289	0.286	0.142	2.032	0.043
H6: Course satisfaction -> Engagement	0.812	0.800	0.071	11.498	0.000

Table 5. Structural Model Results (mean, STDEV, T-values and P-values)

6. DISCUSSION

In this study, we examined how game design elements support and enhance students' basic psychological needs in learning and the need to clarify the role of autonomy, competence, and relatedness. Rooted in the SDT 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. We found that the results provide support for game dynamics induced by reward systems (PBL) and need satisfaction (autonomy) but not competence, as well as the direct effect of autonomy on need satisfaction and intrinsic motivation. As expected, intrinsic motivation (course satisfaction) and gamification outcome (engagement) were positively associated with a gamified system. This result is consistent with Huang and Cappel (2005) who contended that game players fancy entertainment or fun as the primary motivation for playing games and that 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 enjoyment of use. With regard to need satisfaction, students' relatedness with peers contributed to the enjoyment 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 satisfaction 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 with other learners on a gamified platform, there is a likelihood of learning pleasure from the use of gamification. In other words, quality relatedness with game design elements (competition) also predicts quality relatedness with the students taking the course. We also observed that students with a strong sense of social relatedness are in a better position to challenge for trophies, points, and rewards and set expectations and goals that motivate them on such a platform. Thus, effectively handling these relatedness needs is likely to help students negotiate the social media environment (social world) of the classroom and gamification platform successfully, enabling an effective motivation process of learning and social integration interfaces (Wentzel, McNamara Barry, and Caldwell, 2004).

Moreover, considering how autonomy influenced course satisfaction, this is an indication that learners have a sense of voluntary interaction or willingness to be unpressured to engage in gamified systems, which may in turn lead students to experience a high level of pleasure while using gamification. This idea is consistent with SDT in that autonomy is predicted

to redeem the internalization process. Thus, motivation transcends from external to internal rewards or activity to understand the volitional forms of motivation in the context of games and user engagement.

Our study supports other scholars' assertions that autonomous motivation is likely to be aroused by game elements among students when they feel that their basic psychological needs are challenged and valued. According to the data, satisfaction of all three needs mentioned above 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.'s (2017) study. To avoid the pitfall of basic psychological need support (diminishing feelings), this study adopts Ryan and Deci's (2000) 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 behavior 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 relatedness, which is not surprising since SDT asserts that, in terms of intrinsic motivation, autonomy is the most essential (Sørenbø 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, these 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 behaviors to external rather than internal sources (Ng, Sorensen, and 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. 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 [sic] to attain rewards, rather than because the behaviours [sic] are of intrinsic interest.

Interestingly, the data in this study showed that 33.7% of the variance in explaining course satisfaction is determined by the three-psychological-need 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) our finding that adding game elements to educational systems may result in need satisfaction for students. We also found that merely

increasing the fun aspect (hedonic value) for students' gamified involvement without considering their basic psychological needs may lead to less successful engagement with the IS. Therefore, educators should take some steps to meet the students' self-determination requirements (to increase and not reduce course satisfaction) for a successful academic journey. This finding is consistent with the results of Suh, Wagner, and Liu's (2018) study, who recommended not to overlook any of the three above-mentioned psychological need determinants. Accordingly, ignoring any of these three determinants will significantly reduce intrinsic motivation, 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 a gamified environment. For example, educators can provide specific PBL or game elements to improve cognitive and behavioral engagement and design collaborative and interactive learning activities that increase motivation, improve learners' confidence, and reduce disconnection from the gamified IS and flexible learning options (Willems, 2005). 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. IMPLICATIONS AND LIMITATIONS

7.1 Significance and Implication for Research and Pedagogy

One of the contributions and implications of this study is that it extends SDT by identifying the precursors of students' need satisfaction. By framing game elements into PBL (rewards and competition), we explored their effects on students' need satisfaction. Although previous studies have examined need satisfaction in relation to why users play games by linking to intrinsic motivation, such as course satisfaction, in this study, we further introduced engagement in the context of student learning with game design elements in a gamified social media platform. This proposed research model evidenced why some gamified systems are more motivating and engaging than others in addressing students' learning needs. Additionally, in response to calls for identifying the mediating roles between the hedonic and utilitarian values of systems, we introduced the basic psychological need that mediates game dynamics and user engagement. We believe that the mediating role of user engagement will add to the gamification literature by addressing students' basic psychological needs and motivation with regard to the use of gamified ISs.

As an opportunity for promoting innovation in education, our study on gamified social media learning contributes to pedagogical strategies and technological and HEI innovation. Pedagogically, the gamified social media promotes learning and teaching based on personalization (i.e., leveraging student-specific data) to make the customized system more receptive. This helps redefine the roles of the learners as not only taking

responsibility for their learning needs but also providing support to colleagues and engaging in discussion to create contents and milestones. Simultaneously, teachers become mediators, coordinators, or referees rather than lecturers or instructors on the gamified social media platform. Technologically, gamified social media increases the availability and accessibility of learning materials, provides different game design elements for personalized learning, and nurtures capabilities in developing flexible skills. Institutionally, gamified social media contributes to HEIs innovation by making education more open and dynamic (especially in this COVID-19 era). HEIs have to evaluate their learning management systems or online learning communities for a possible integration of game design elements rather than developing full-fledged gamification to enable a flexible learning continuum.

7.2 Implications for Practice

We believe that this study will be beneficial for educators, especially when designing gamified learning materials. The findings indicate that the competition or challenges among students on gamified platforms 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 leader board 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, leader boards, and badges allow students to recognize each other's accomplishments, which in turn promotes friendly learning competition and enhances 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. Systematically, this study shows how game dynamics can be conceptualized in practical life to encourage societal needs in rewarding the best-performing users and how game design elements can be utilized in the classroom settings to complement traditional classroom activities.

7.3 Limitations and Recommendations

Despite our efforts to increase the rigor of our methodological approach, this study had some limitations. First, this study was performed at an HEI in a country with a developing economy (Ghana) which limits the generalizability of the results. Therefore, future research should extend this study by examining other disciplines, countries (cultures), and regional contexts.

Six out of the eight hypothetical relationships yielded positive results in the structural equation model which is inadequate to conclude a causal relationship. 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.

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 the ways in which

competence (self-determination), course satisfaction (intrinsic motivation), and rewards (game dynamics) interact in a gamified learning environment to engage students.

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 gamified social media learning in HEIs. The insights obtained in this research provide implications for gamified learning directions and support for both educators and students. This study also serves to highlight and broaden our knowledge of the complex nature of student engagement, motivation, game design elements, and their antecedents and derivatives to HEIs in implementing gamification in education, as well as flourishing online learning environments to complement classroom activities. More importantly, future studies can look beyond user learning engagement and measure performance (short or long-term) as an outcome. From the model, performance measurement can be categorized into user performance, system performance, and task (course) performance.

8. CONCLUSION

In this study, we examined the game dynamics, self-determination, and user engagement in a gamified learning environment. The ease and invasion of smartphones among students have resulted in many forms and uses of social media applications. Previous studies have looked at the implications of social media use on student's performance. However, little is known of the influence of game dynamics on students' learning performance. Thus, this study focused on how game design elements support and enhance students' basic psychological needs in learning computing education in a gamified social media platform. The results of the study showed that students experienced satisfaction with the computing education course via the game design elements. Additionally, the study emphasised the positive relationship between the gamification application for computing education course and perceived learning engagement outcomes. Students' psychological (autonomy and relatedness) need for learning computing education was positively improved with the use of gamification for academic purpose and communication of socially-related learning association among students was positively related to perceived course satisfaction.

Further, the study emphasized that the students were more aligned to autonomous feelings in learning computing education than to competence and relatedness. Thus, the influence of autonomy was stronger than competence and relatedness, and this is no surprise since SDT asserts that among the intrinsic motivation, autonomy is the most essential element.

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