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FOSTERING STUDENT NURSES' SELF-REGULATED LEARNING WITH THE SECOND LIFE ENVIRONMENT: AN EMPIRICAL STUDY

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ABSTRACT

Aim/Purpose	This study investigated the potential use of Second Life (SL) to facilitate nursing students' confidence and motivation, as well as its impact on their self-regulated learning development.
Background	The current emphasis on nursing education in general has resulted in more consideration of different virtual learning environments as a means for assessing individuals' learning in a healthcare context.
Methodology	A quantitative research approach employing the survey method was used in this study. A model fit for Partial Least Squares (PLS) technique on 218 participants was produced to estimate the direct effect of environmental elements in terms of environment content design, environment interactivity, and environment functionality on student nurses' behaviour in terms of motivation and confidence. In addition, the direct effect of student nurses' behaviour on the development of their self-regulated learning was also examined and discussed. Two SL medical scenarios were designed to facilitate nurse students' mastery of the learning task.

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Contribution	This study shows the potential of using SL for empowering nurses' self-regulated learning and collaborative learning. It extends the current understanding on how SL can assess nurses to learn about clinical related matters through the control of teleported characters (avatars), thus enhancing self-regulation.
Findings	This study found that SL content design, functionality, and interactivity can positively affect nursing students' learning by providing them with the necessary elements to stimulate their confidence and motivation. We also found that nursing students' confidence and motivation when using SL have significantly contributed to their self-regulated learning.
Recommendations for Practitioners	Findings from this study can help educational decision makers to consider the use of seamless learning environments, like the SL, to help students solve problems and generate alternative responses to their issues.
Keywords	Second Life, nurse education, higher education, online learning

INTRODUCTION

With the current development in the nurse education practices, it becomes essential that current technologies can be used to provide a meaningful environment to further empower these practices (Melnyk & Fineout-Overholt, 2010). Bowen, Lyons, and Young (2000) underline the various challenges that would face the teaching and learning process of nurses to gain new skills. Therefore, nurses' knowledge about nursing practices must be upgraded from time to time (Zoraini Wati, Nafsiah, & Phua, 2003). This fact was driven by the educational background of nurses in different health care sectors. One problem arises when there is a shortage of time that is required for nurses to attend training programmes (Pasila, Elo, & Kääriäinen, 2017). It is also assumed that the use of Second Life (SL) in nursing education may offer an alternative tool for student nurses by providing an exciting and accessible form of learning environment for nurse education that can potentially develop their sense of confidence and motivation. It is also evident that students' levels of motivation may influence their effort and the approaches they take to learning and applying new concept (Robb, 2016). Hence, it was further believed that such experience can help increase nurse students' self-regulated learning in an online environment; self-regulated learning refers to the motivational orientations and learning strategies that students employ to attain desired goals (Pintrich, 1995).

The lack of understanding concepts related to patient care may result in poor adherence to certain treatments or practices among nurses. A number of previous studies have reported the main challenges faced by student nurses to participate in online learning activities in terms of the following: (1) Lack of time to learn due to rapid patient discharge from care can discourage and frustrate the nurses to attend the training programmes (Chong, Sellick, Francis, & Abdullah, 2011); (2) Limited access to a suitable learning environment (Kang, Chiu, Lin, & Chang, 2016); (3) Lack of support and effective cooperation between nurses (Anderson et al., 2016); and (4) Lack of willingness to take responsibility due to the limitation in nurses' confidence and control (Connor, Dwyer, & Oliveira, 2016).

On the other hand, the lack of current teaching and learning methods to convey the complex nursing procedures have affected and continue to affect student nurses' responsibilities in practice (Bastable & Gramet, 2010). Such lack was noted to be associated with the development of student nurses' self-regulated learning in a context specific condition. For example, the students with a low degree of self-skills can hardly adapt to a challenging task, adjust appropriately to the learning environment, and process information (Salamonson et al., 2016). This is why student nurses need to be equipped with a spectrum of confidence and motivation (Toode, Routasalo, & Suominen, 2011) that will assist them in fulfilling their roles as effective health care providers. In addition, the current learning and teaching practices of nursing are needed to be changed from task oriented to role oriented (Pasila et al., 2017; San Jose, 2017). However, the main environmental antecedents that may contribute to individuals' motivation and confidence in a learning context are still emerging. According to Pu, Wu, Chiu, and

Huang (2016) and Yu, Chen, Yang, Wang, and Yen (2007), various environmental elements may contribute to the development of authentic learning in vocational nursing practice course. They highlighted the importance of content design for online learning environment in promoting certain learning outcomes. In most online learning studies (e.g., Chen & Kalay, 2008; Schmeil & Eppler, 2008; Smelik, Tutenel, de Kraker, & Bidarra, 2011; Thurmond & Wambach, 2004) the emphasis was given to the design of learning content for stimulating certain learning goals. Previous studies also addressed the role of environment functionalities (involve tools) for facilitating individuals' learning experience in a learning space. For example, Yang, Chuang, Li, and Tseng (2013) argued that environment functionalities to individualized instruction are still emerging and need further consideration. This is also supported by Bauters, Lakkala, Paavola, Kosonen, and Markkanen (2012) who emphasized the need for considering environment functionalities when assessing or examining users' experience in a learning situation. In addition, previous studies (e.g., Bonini, 2008; Meinel & Chujfi, 2017; Roussou & Slater, 2005) also showed the role of environment interactivity in facilitating individuals' monitoring of the activity by motivating them to continuously engage in mutual dialogue. Based on these, this study considered the role of environment content design, functionalities, and interactivity in promoting nursing students' confidence and motivation to learn in SL for enhanced self-regulation. Furthermore, the effectiveness of SL in developing individual's self-regulated learning is not well researched (Moore, Prentice, & Salfi, 2017; Pfaff, Baxter, Jack, & Ploeg, 2014). Thus, outcomes from this study can help educational decision makers to better understand the potential of SL in providing the environmental antecedents for nursing students to experience an increased self-regulation.

Theoretical Background

In this work, the simulation theory by Gallese and Goldman (1998) and the self-regulation theory by Bandura (1991) were used to explain the potential of using SL in nurse education. Gallese and Goldman (1998) explained how an individual can adopt the circumstances of an environment and then use one's own mental apparatus to generate mental states and decisions. This process promotes the individuals' decision-making process (Gordon, 1992), which led us to assume that when student nurses use SL, they will be more likely to process information adequately. For example, student nurses can be stimulated by the SL antecedents such as content design, interactivity elements (such as chatting, free navigation, and customization of the space), and functionalities. These, as a result, will drive student nurses' decision-making process by gaining the required control for completing the task. In addition, Mosler, Schwarz, Ammann, and Gutscher (2001) stated that when an individual perceives the relevance of an environment, motivation level will be high. This is also found to help build student nurses' confidence to apply the learned concept in a virtual space (Shorey, Siew, & Ang, 2018).

The association between the SL factors such as functionalities and interactivity can be used as a way for enriching the constructivist concept of a microworld with the simulation characteristics. SL content design seems to offer important implications to the overall interactivity of a person when learning about certain topics. Although SL may be designed as an expandable simplest case of a system that aims at engaging students in active learning experience, this, in and of itself, requires other environmental elements in order to satisfy the requirements of self-regulated learning (Thoman, Sansone, & Geerling, 2017). Thus, it is assumed that the content design of the SL environment can potentially play a role in boosting the interactivity of a learner. Furthermore, the study of the relation between interactions and academic performance in SL supported courses is the object of study of effective learning (Mauldin Pereira et al., 2018). Hence, lack of interactivity in the design of an environment may limit the sharing and learning of members in a group. Bain and Zundans-Fraser (2017) linked interactivity to the functionality of the system to carry out the interactivity elements for an individual to process a learning activity. But building interactivity into SL environments that include support for self-regulation can typically contribute to one's learning experience by increasing the motivation for students to engage in a learning experience.

The self-regulation theory by Bandura (1991) posits that individuals may not be able to increase their motivation in a task if they do not pay adequate attention to their performance, the conditions under which they occur, and the immediate effects they produce. Thus, Bandura argued that self-regulation can be associated with the fidelity, consistency, and temporal proximity of self-monitoring. In this study, it is assumed that student nurses using the highly interactive mode with regard to user friendly interface, information presentation, classification, navigation, artistic design, and personalization may increase their level of motivation and confidence (Harte et al., 2017). All these are believed to promote individuals' self-monitoring of their progress in the learning task, thus increasing their self-regulation. Precisely, it is assumed that when nurses use SL, they can work through their avatars to learn and work with peers within the same environment. This phenomenon can be explained by how certain task and technology characteristics can potentially influence individuals' behavioural outcomes that depend jointly on motivation (known as intention) and learning ability (known as monitoring).

Research Model

The use of SL can drive nurse students' motivation and confidence in order to process a better self-regulated learning. Bastable (2003) acknowledged that behaviourists recommend either altering the stimulus conditions in the environment or changing what happens after a response occurs, which also depends on the motivation to reduce some drive, in terms of learning and changing. On the cognitive aspect, this study examined the extent to which SL could be used to create innovative learning experiences by enabling students to handle conceptual and procedural problems. This led us to consider the model of self-regulated learning by Schmitz and Wiese (2006) to explain how individuals' self-regulation may promote their level of motivation and confidence in the learning process.

The proposed research model is presented in Figure 1.

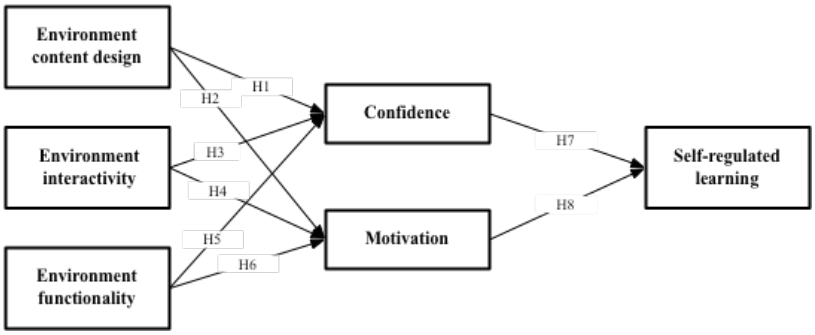

Figure 1. The proposed model

The construction of the research hypotheses was based on the evidences in the previous literature. For example, Young (2002) describes this emergent e-learning environment as one that is "adapted and developed for intellectual partnerships." Curran, Fleet, and Kirby (2010) addressed the importance of environment content design on an individual's confidence to complete a task. This includes the association between scheduled learning and asynchronous learning activities that are typically facilitated through the use of real-time systems. Meanwhile, Pellas, Kazanidis, Konstantinou, and Georgiou (2016) stated the dimensions of effective design based on the characteristics of instructional content may lead to a higher confidence to revisit and use an environment. Park and Braud (2017) highlighted the potential of environmental content design in driving one's confidence to learn and interact with others. The same view was found by Hew, and Syed Abdul-Kadir (2016) who declared the role of content design in regulating one's interest to continue with the task is based on the psychological needs within the social context. Thus, it is hypothesized that:

H_1: There is a significant effect of environment content design on student nurses' confidence.
H_2: There is a significant effect of environment content design on student nurses' motivation.

Online systems that offer a different means for learning rely on the interactions among students themselves, the interactions between faculty and students, and the collaboration in learning that results from these interactions (Glover & McDonald, 2018). The e-learning system reviewed provides means for student/teacher interactively, and between students. Barrett, Stull, Hsu, and Hegarty (2015) and Schaffer, Tiffany, Kantack, and Anderson (2016) stated the importance of system interactivity in promoting learners' motivation through the individual intrinsic motivation in determining effort and whether students perceive the system to be useful. Lau and Lee (2015) asserted that for a system to be effective, it must ensure the embedment of interactivity elements that are believed to drive individual motivation and confidence to learn further about the task. The relationship between a person's confidence and environment is determined mostly by the way he/she controls the activity (Abbad, Morris, & De Nahlik, 2009). Based on these, it is hypothesized that:

H_3: There is a significant effect of environment interactivity on student nurses' confidence.
H_4: There is a significant effect of environment interactivity on student nurses' motivation.

The functionality of an environment here refers to the perceived ability of SL to provide student nurses with flexible access to instructional and assessment media. Users are permitted to discover course substance, submit assignments, and complete exams on the web. As per Seels and Glasgow (1998), electronic learning frameworks enable these by coordinating media, like sound, feature, and message, that are controlled by the framework programming, the learner, or both. Further, the e-learning framework under study was likewise planned to permit remote access, with boundless access to course content, essential for advancing learning frameworks. Stickler and Hampel (2010) highlighted the role of system functionality in directing users' confidence to achieve their learning goals. McDowell, Werner, Bullock, and Fernald (2006) reported the needs for providing the suitable functionality for learners to perform the task. They stated that one's outcome may change based on the way one handles a learning task. Messaoud, Cherif, Sanza, and Gaildrat (2015) addressed their view from the motivation perceptive where environmental functionality was found to play a key role in helping learners to be motivated to continue a learning task. As such, it is hypothesized that:

H_5: There is a significant effect of environment functionality on student nurses' confidence.
H_6: There is a significant effect of environment functionality on student nurses' motivation.

Self-confidence is the belief in a learner's ability to carry out tasks with a learning management system. A student with confidence in using SL may view it as easy and useful, and will more willingly accept and use the system. Bandura (1988) defines self-confidence as a construct to explain how well a person can carry out a task to realize a goal. He stressed the importance of differentiating between component skills to perform an act. It is necessary to acknowledge both the degree and strength attributes in measuring self-confidence. Bandura further covered the psychological construct of self-efficacy as a concept that referred to beliefs in one's capabilities to mobilize the motivation, cognitive resources, and courses of action needed to meet situational demands. Creasey, Jarvis, and Gadke (2009) and Gita and Apsari (2018) acknowledged the potential of certain environmental elements in predicting and promoting the relationship between students' confidence and self-regulated learning when the students take an active participation in the educational process. Lau, Kitsantas, Miller, and Rodgers (2018) showed how a well-designed learning environment may provide a foundation for self-regulation and self-efficacy in which understanding these developments may help institution to better foster students' confidence and self-regulation strategies. Therefore, the following hypothesis was formed:

H_7: There is a significant effect of confidence on student nurses' self-regulated learning.

Motivation refers to students' subjective experiences and desire to study or learn a topic, particularly students' willingness to participate in learning activities (Schunk, Pintrich, & Meece, 2008). Druger (2006) expressed that a standout amongst the most key points of a school science courses guide is to increase students' motivation to learn the course material. Other previous studies (e.g., W. H. Chong, Liem, Huan, Kit, & Ang, 2018; Lee & Turner, 2017; Wang, Chen, Lin, & Hong, 2017) addressed the

positive relationship between individuals' motivation and self-regulation through the facilitation of ubiquitous learning with advanced technologies. Shyr and Chen (2018) asserted that the relation between students' motivation and self-regulation is centered on helping students to set goals, monitor their progress, evaluate their progress against reasonable standards, and provide themselves with appropriate self-reactive consequences and has proven valuable and revealed context-specific improvements. This includes individual's determination of learning which characterizes the control an individual believes to process over the learning situation (Black & Deci, 2000). As such, it is hypothesized that:

H_8: There is a significant effect of motivation on student nurses' self-regulated learning.

METHOD

PARTICIPANTS

A convenience sampling method was used to recruit 218 nurse students from different higher education institutions. All participants were asked to register for personal accounts on the Second Life environment. The demographic characteristics examined in this study include gender, age, and experience in using the SL environment (Table 1). The majority of the respondents in the sample, that is 190 (87.15%), were females while the remaining 28, representing 12.85 % were males. Regarding the age group, 66.97% of the participants were in the age group of 18-23 years. This is followed by those in the age group of 24-29 years, which accounted for 33.3% of the sample.

Table 1. Demographic Characteristics of the Respondents (N=218)

Characteristics	Classification	N	Percentage (%)
Gender	Male	28	12.85
	Female	190	87.15
Age	18-23 years old	146	66.97
	24-29 years old	72	33.03

All the participants had an active account on SL, but no experience with its use in learning.

INSTRUMENTS

All measures used in this study were adapted from previous studies with valid and reliable measures of corresponding constructs using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Since the research adapted most of the items, validity and reliability were examined to ensure the modified scales were acceptable. Three lecturers with experience in health sciences were asked to validate the research instrument. The experts' academic background was in medical education under the school of nursing. They had 6-8 years of experience in using the Learning Management System (LMS) in their teaching. They were asked to look at the questionnaire and to provide information including the suitability of phrases and clarity. Based on feedback from the three lecturers, changes were made to the questionnaire with regard to instrument styling, clarity, and format. Table 2 is a summary of the number and source of items used in testing each construct. More details about the items for each construct are provided in the Appendix. A pilot study was then carried out among 35 student nurses. We distributed the modified version of the questionnaire to these 35 participants via email from the identified population. The reliability of the construct items was specified with Cronbach's alpha. The average Cronbach's alpha coefficient value was 0.76 (ranged from 0.72 to 0.82), which exceed the conventional suggested cut-off criterion of 0.70.

Table 2. Measurement of the variables

No.	Construct	Items	Source
1	Environment content design	6	Adapted from B.-C. Lee, Yoon, & Lee (2009)
2	Environment interactivity	8	First 3 items were adapted from Liaw (2008) and other 5 items from Lewis (1995).
3	Environment functionality	7	Adapted from Poelmans, Wessa, Milis, Bloemen, & Doom (2008)
4	Confidence	7	3 items were adapted from Bers, Doyle-Lynch, & Chau (2012) and other 4 items from Liaw (2008)
5	Motivation	13	Adapted from Glynn, Brickman, Armstrong, & Taasoobshirazi (2011)
6	Self-regulated learning	12	Adapted from Lan, Bremer, Stevens, & Mullen (2004)

Procedure

The data were collected from student nurses who were asked to register and join the SL nursing group within the medical category. An invitation to all nurse students was sent via email with full demonstration about the purpose of this study. Then, an email was sent to their account containing a link to the online survey. The participants were asked to follow the guide to the scenario in the SL environment. This included reading procedural instructions about the task that was provided in the entrance of the SL space. The students' activities (logs) were recorded to ensure that students were actively using the SL environment. Students who were interested in taking part in the research were given information about the date and time of the learning session. The identified students were asked to participate in one medical scenario (see below) based on groups of 3-5 individuals. Individual students in each group were asked to enter the SL environment and to sign an informed consent. After signing out from the SL environment, the student nurses were asked to respond to an online questionnaire.

The Medical Scenario

The learning materials in the SL environment were designed with the consideration of providing relevant instructions related to receiving patients in the emergency room. There were two scenarios used in this study: "Heart failure problem" and "Respiration problem." Both scenarios were designed according to Gagne's hierarchies of learning and based on the two domains of learning of verbal information and intellectual skills.

In the first scenario, student nurses were asked to use LifePak Defibrillator and follow the medical procedure for operating the defibrillator in which a small window was designed to guide them to configure the device and observe changes in the defibrillator pulse sound. Other operational objects such as Crash Cart, Defibrillator Paddles, Cardio Pump, Ambu-Bag, Stethoscope, and Syringe were provided. Students were also instructed to use the ventricular tachycardia rhythm attached to the patient's heart, particularly to provide some inputs to help students estimate the heartbeat of the patient. Then, when students operated the Bradycardia rhythm from the monitoring screen, they were asked to interpret changes in the patients' health. Students were expected to react to the slow heart beats accordingly either by performing an artificial respiration (CPR) to the patient's chest or using the defibrillator machine.

In the second scenario, the students were asked to help the patients when they noticed problems with their breathing; this was achieved by instructing them to change the patients' oxygen level. When the

nurse selects the anaesthesia machine, a window of options was provided to help them set the level of oxygen connected through mask and control the ventilator (see Figure 2). In this setting, students were expected to be able to set the rate on the ventilator using four different oxygen rates. After that, students were asked to set the volume of oxygen needed to stabilize the breathing of the patient using three different speeds. Students were also allowed to use the anaesthesia machine to decide the volume of gas by using the gas mix function which consist of five different gas types like 100% Oxygen, Pure Air, Sevoflurane, Isoflurane and Nitrous oxide (N2O) 50%.

Figure 2. Patient with five types of gas

RESULTS

DESCRIPTIVE STATISTICS

The descriptive statistics of the constructs are shown in Table 3, which presents the obtained means and Cronbach's Alpha for each variable in this study. From the result, it can be said that all means were above the midpoint of 3.00, and all constructs had an acceptable reliability and scored well above 0.7 (0.847 to 0.948).

Table 3. Summary of descriptive statistics (N=218)

Construct	Number of items	Mean	Cronbach's Alpha
Environment content design	6	4.141	0.879
Environment interactivity	8	3.778	0.848
Environment functionality	7	3.678	0.877
Confidence	7	3.986	0.847
Motivation	13	3.767	0.932
Self-regulated learning	12	3.574	0.948
Overall			0.888

ASSESSMENT OF PLS-SEM PATH MODEL RESULTS

In the light of the recent development about the unsuitability of PLS path modelling in model validation, the present study adopted a two-step process to evaluate and report the results of PLS-SEM path, as suggested by Henseler, Ringle, and Sinkovics (2009). This two-step process adopted in the present study comprises (1) the assessment of a measurement model, and (2) the assessment of a structural model (Hair, Sarstedt, Hopkins, & Kuppelwieser, 2014).

Assessment of the Measurement Model

Convergent validity is typically examined by assessing how multiple items can be used to examine the agreement of a concept in a set of variables. As advised by Hair, Black, Babin, & Anderson (2010), we considered the use of factor loadings, composite reliability, and average variance extracted in order to examine the convergent validity of items in a model.

Furthermore, previous studies like Fornell and Larcker (1981) advised that the values obtained from convergent validity test can be used to achieve convergent validity of the scales by assuming that all the loading values for all items is greater than 0.5. Here, we considered that a factor loading value for an item less than 0.7 can help to assess whether the item should be eliminated or not (Hair, Hult, Ringle, & Sarstedt, 2013). In general, items with loadings of less than 0.5 should be dropped (Hulland, 1999). Four items with loading less than 0.5 were dropped, which were CONF1, EF7, EI1 and MOT13. Items SRL12 and MOT7 remained for the theoretical purposes even though they have loadings between 0.639 and 0.554 respectively. Results show that the rest of the factor loading values are greater than the recommended level (0.7). The composite reliability (CR) values of the components (ranging from 0.91 to 0.95) exceeded the generally accepted value of (0.70). The AVE values (ranging from 0.62 to 0.69) are higher than the general accepted value of 0.5. Thus, the criteria fulfilled and the empirical data in this study assure convergent validity as shown in Table 4.

Table 4. Results summary for the measurement model (N=218)

Constructs	Items	Main loading (>0.70)	AVE (>0.50)	CR (>70)
Environment content design (ECD)	ECD1	0.828	0.624	0.908
	ECD2	0.814		
	ECD3	0.829		
	ECD4	0.703		
	ECD5	0.815		
	ECD6	0.740		
Environment functionality (EF)	EF1	0.780	0.687	0.929
	EF2	0.825		
	EF3	0.852		
	EF4	0.844		
	EF5	0.857		
	EF6	0.813		
Environment interactivity (EI)	EI2	0.749	0.618	0.951
	EI3	0.823		
	EI4	0.756		
	EI5	0.814		
	EI6	0.831		
	EI7	0.795		
	EI8	0.677		

Constructs	Items	Main loading (>0.70)	AVE (>0.50)	CR (>70)
Confidence (CONF)	CONF2	0.811	0.657	0.920
	CONF3	0.816		
	CONF4	0.815		
	CONF5	0.833		
	CONF6	0.837		
	CONF7	0.747		
Motivation (MOT)	MOT1	0.782	0.647	0.946
	MOT2	0.750		
	MOT3	0.768		
	MOT4	0.793		
	MOT5	0.752		
	MOT6	0.793		
	MOT7	0.554		
	MOT8	0.813		
	MOT9	0.804		
	MOT10	0.803		
	MOT11	0.808		
	MOT12	0.789		
Self-regulated learning (SRL)	SRL1	0.793	0.638	0.955
	SRL2	0.810		
	SRL3	0.830		
	SRL4	0.734		
	SRL5	0.808		
	SRL6	0.817		
	SRL7	0.818		
	SRL8	0.814		
	SRL9	0.842		
	SRL10	0.822		
	SRL11	0.840		
	SRL12	0.639		

Based on the standards recommended by Fornell and Larcker (1981), discriminant validity of the scales is satisfied when the square root of the Average Variance Extracted (AVE) values from the

component is greater than the variance of any of the inter-component correlations. As shown in Table 5 the AVE values on the diagonal are greater than the correlation coefficient of that component with all the other components in the model. This shows that the discriminant validity was fulfilled for all components, and inner model is ready for hypothesis testing.

Table 5. Correlations and discriminant validity (N= 218)

	CONF	ECD	EF	EI	MOT	SRL
CONF	0.810					
ECD	0.214	0.790				
EF	0.237	0.220	0.829			
EI	0.278	0.264	0.232	0.779		
MOT	0.268	0.364	0.256	0.402	0.770	
SRL	0.291	0.307	0.210	0.229	0.326	0.799

Assessment of the Structural Model

This section examined the structural model by examining the coefficients of path cross all the relationships between model constructs. And also identified the R^2 values, which refers to the total variance in the dependent variable used to explain the independent variables. We examined the study hypotheses by indicating the *t*-statistics to measure the standardized path coefficients based on bootstrap of the sample with 5000 samples. The estimates of the R^2 values represent the amount of variance in the dependent variable explained by the independent variables. In general, R^2 values of 0.00 - 0.25 mean small; 0.25 - 0.50 mean medium and 0.50 - 0.75 mean large (Hair et al., 2013) (see Figure 3 and Table 6).

Table 6. Result of the final structural model (N=218)

Endogenous variables	**Determinant**	**Path (*t*-value)**	**Decision**
Confidence ($R^2 = 0.123$)	ECD (H_1)	0.1237 (1.5949)	Not supported
	EI (H_3)	0.2076 (3.0432)	Supported
	EF (H_5)	0.1618 (2.2851)	Supported
Motivation ($R^2 = 0.248$)	ECD (H_2)	0.2554 (3.7864)	Supported
	EI (H_4)	0.3043 (4.6407)	Supported
	EF (H_6)	0.1286 (2.3955)	Supported
Self-regulated learning ($R^2 = 0.151$)	CONF (H_7)	0.2194 (3.2668)	Supported
	MOT (H_8)	0.2672 (3.7954)	Supported

Table 6 shows hypotheses testing results. Seven of eight relationships were supported while the first hypothesis was not supported. The first hypothesis shows that the relation is not significant, which infers that the environment content design does not affect positively on user's confidence (β= 0.124, *t*-value= 1.595). Hypothesis two shows a significant positive relation between environment content design and user's motivation (β= 0.255, *t* value= 3.786). Hypothesis three shows that any increase in environment interactivity will increase user's confidence (β= 0.208, *t* value= 3.043). Hypothesis four also shows that any increase in environment interactivity will increase user's motivation (β= 0.304, *t*

value= 4.641). Regarding hypothesis five, H_5 infers that environment functionality predicts positively user's confidence which is significant (β= 0.162, *t* value= 2.285). Hypothesis six infers that environment functionality affects positively on user's motivation (β= 0.129, *t* value= 2.395). Hypothesis seven testing infers that any increase in user's confidence will significantly increase self-regulated learning (β= 0.219, *t* value= 3.267). Also, hypothesis eight show that any increased level of user's motivation is accompanied with higher level of self-regulated learning; (β= 0.267, *t* value= 3.795).

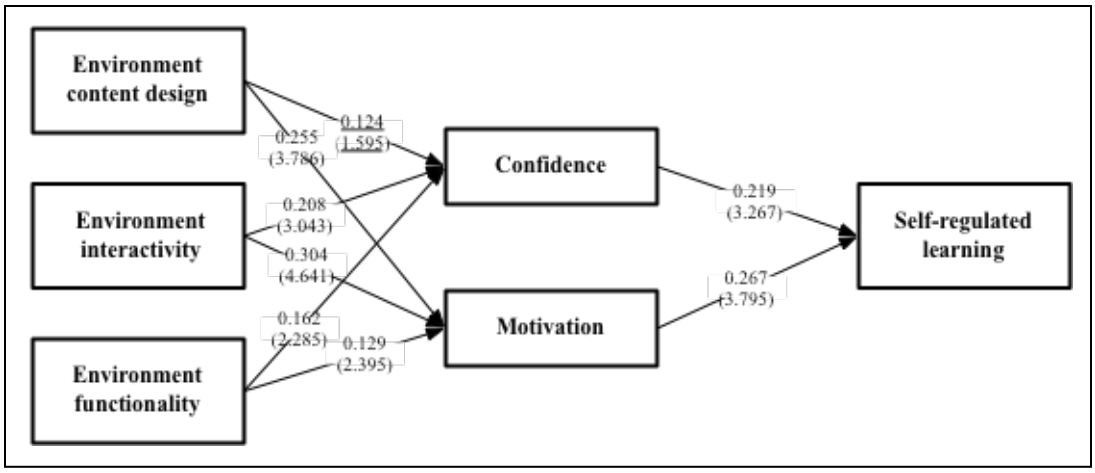

Figure 3. The tested model

In summary, all effects in the model were significant except the effect predicted by Hypothesis 1, thus supporting seven of the eight proposed hypotheses. Learner self-regulated learning was highly influenced by confidence and motivation, and confidence and motivation were significantly affected by the environment content design, environment interactivity, and environment functionality. The only unsupported hypothesis was that environment content design would influence their confidence.

DISCUSSION

This study found that using SL can stimulate nursing students' confidence and motivation, thus promoting their self-regulated learning. In addition, this study found no significant influence of environment content design on nurses' confidence. One reason for this can be that nurse students' confidence to complete the task might be influenced by the design of the environment (Kaufmann, 2003). More precisely, it is believed that SL may have been developed from the participative philosophy (the belief that individuals will take more interest in their work if they are allowed to make meaningful contributions to it) where less emphasis is given to the compatibility of the design with the actions similar to the real world settings. In addition, the way in which information is being shared among users in the environment may not maintain their privacy since all nurses can view and see what other nurses are doing. Meanwhile, when student nurses perceive the environment to provide the design criteria that are likely to support their interaction, it is more likely they would count it to be part of the learning process and not necessarily a driver of their confidence. This might negatively affect their confidence towards the design of the environment. Others like Hung, Smith, and Smith (2015) asserted that the availability of certain features in the environment may influence learner's schemata (cognitive structure), thereby increasing the cognitive load and hindering the confidence level. Furthermore, such lack of confidence to use SL among nurses can be explained by Pellas et al. (2016) as the effect of pedagogical content design principles on individual's confidence to use a system.

The result also showed a significant positive relation between environment content design and users' motivation. One reason for this can be that most student nurses in SL were able to interpret and use the learning contents to complete the learning task. Such assumption can be explained from the views of Hew et al. (2016) who stated that the use of online environment may offer the psychologi-

cal needs inline within the social context, which can act as a key role in promoting the motivational processes from the psychological perspective. Furthermore, it is believed that nurses were able to understand and make meaning of the equipment to examine patients' medical state. As such, it is assumed that nurses will be motivated to use the SL without any external pressures or interferences, allowing them to progress throughout the learning phases in their own ways. This finding can be used to enrich previous efforts on how the clarity of content design in a virtual world can promote users' motivation to understand the given information. For example, it adds to Yueh, Chen, Lin, and Sheen (2014) who questioned the role of content design in favouring learners' experience in the virtual learning environment. It also supports the argument of Ip and Li (2015), Sadoux, Rzycka, Jones, and Lopez (2016), and Hsu, Kuo, Liang, Lee, and Thomsett-Scott (2016) who have addressed the needs for effective instructional and content design in virtual worlds in order to maintain learners' intrinsic motivation.

The results showed that any increase in environment interactivity will increase user's confidence. Nurses found SL to provide them with the interactivity elements necessary for controlling and navigating through the environment. For example, SL offers a full customization of the user interface in order to accommodate users' needs in terms of text chatting, voice chatting, avatar customization, view-port dimensions, etc. It is also believed that nurses had an opportunity to interact with the various equipment in SL, in which they were exposed to the process needed to complete a task through active communication. Most previous studies on virtual environment design interactivity (e.g., Bredl, Groß, Hünniger, & Fleischer, 2015; Siriaraya & Ang, 2014) have emphasized how users prefer and benefit from interactive applications that can be enjoyed in a social setting. This includes the freedom to move around the environment, try out different activities, and engage in peer to peer communication. Our finding supports the work of Cruz-Benito, Therón, García-Peñalvo, and Lucas (2015) on how sustaining users' interaction in the virtual environment may help to increase their confidence to do things that they cannot do in the real world. It also supports the view of Goel, Johnson, Junglas, and Ives (2013) on the need for active communication in order to ensure users' continuous interaction with the environment and the task. Based on these, it is commonly agreed that when an environment provides the interactive elements required to perform a certain task, then users are expected to experience high level of confidence.

The environment interactivity of SL had a positive effect on nurses' motivation. It is assumed that SL allowed nurses to learn within a simulation of real-world practices. Such practices are believed to shape nurses learning meaningfully through the direct interaction with the environmental objects, which include regulating the measures in monitoring devices, customizing the display, etc. This implies that nurses may have perceived themselves to be partially inside the simulated environment when they were actively engaged to set and measure changes in patients' health (Birk, Atkins, Bowey, & Mandryk, 2016; Heemskerk, Kuiper, & Meijer, 2014). This study supports the argument of Barrett et al. (2015) and Zhang, Lu, Gupta, and Zhao (2014) about the benefits of interactivity features to enable users to portray a desired self-image that would positively increase their motivation to use online systems. It also adds to the work of Schaffer et al. (2016) on how a learning experience from using SL can effectively shape learning about public health nursing when compared with on-site clinical experiences. Such experience driven from active interaction with the SL elements may positively influence nurses' motivation to complete a task. Thus, it can be concluded that SL offers the interactive features for nurses to be motivated to learn about relevant subject matter.

The results also showed no significant effect of environment functionality on student nurses' confidence. The use of SL among nurses can be said to facilitate their control of virtual objects with the ability to manipulate and control the virtual objects easily, thus enabling them to complete the learning task. Chryssolouris, Mavrikios, Fragos, and Karabatsou (2000) emphasize the importance of environmental functionalities in shaping one's usage experience. In the SL environment, students found that their interaction with each other was influenced by the functionalities of the SL environment by allowing them to freely explore the learning activities. In addition, SL functionalities, such as the

walk-through function, Power Point presenter, note-card giver, survey tools, and monitor screen options, were deemed necessary to promote their confidence to complete the task. This finding extends previous studies' understanding (e.g., Dib, Adamo-Villani, & Garver, 2014; Moser-Mercer, Class, & Seeber, 2005; Perera, Allison, & Miller, 2013) on how providing the core functionalities can advance individual's behavioural beliefs.

The obtained results revealed that the environment functionality of SL had a positive effect on nurses' motivation by increasing their desire and willingness to learn about the task. Previous studies like Ştefan and Moldoveanu (2015) and Messaoud et al. (2015) asserted that virtual environments would provide a rich set of functionalities and potential to decide whether the information is necessary to use the object to reach a goal. Monterrat, Lavoué, and George (2014) suggested that an environment should provide wide range of functionalities for users with differing needs and expertise to support exploratory search, rich data history, and processes that promote collaboration. This finding adds to the study of Messaoud et al. (2015) by explaining how the functional benefit from using a system to increase individual's motivation can be promoted by active communication, effective enquiring, and control of the objects within the environment. Based on these, it can be concluded that SL was able to promote users' (nurses) motivation by providing the necessary functionalities for them to communicate, enquire, and control the objects within the environment.

We also noted that increasing nurses' confidence will significantly increase self-regulated learning. This can be that student nurses' progress in a learning task along with the peer's support made them more capable of transforming their mental abilities into skills for tackling the learning task. From the literature (Dabbagh, Kitsantas, Al-Freih, & Fake, 2015; Lester, Mott, Robison, Rowe, & Shores, 2013), it is evident that using virtual worlds would help in developing students' self-regulated learning through active participation in an environment that engages students in the process of goal setting, task strategies, self-monitoring, and self-evaluation. This is in line with the work of Keleekai et al. (2016) who argued that a significant improvement in nurses' confidence could be achieved with the use of a simulation-based blended learning program. They believed such improvement in nurses' confidence to use an environment could be associated with their overall learning outcomes. This study also adds to the previous work of Bers et al. (2012) on the importance of SL in providing the main elements for promoting students' confidence to perform in a task. Our finding contributes to the self-regulated theory by explaining how individuals' confidence can drive their ability to complete the task. Precisely, the use of SL allowed nurses to develop the skills required to solve a learning task by providing them with the relevant hints and cues to understand the necessary steps for accomplishing a task. These are believed to empower the learners' confidence to achieve their objective in solving clinical problems. In addition, various cognitive and emotional demands help the nurses to build their confidence. Thus, this finding contributes to the self-regulated theory by explaining how individuals' confidence can drive their ability to complete the task.

Finally, nurses' motivation to learn in SL had a positive effect on their self-regulated learning. It can be argued that SL provided nurses with a reason to learn in a way that falls within their ability, which as a result increased their self-regulated skills. This is believed to enable students to use SL effectively. Nurses were mostly motivated to learn and explore various learning events in SL that guided their metacognition (thinking about one's thinking) and their strategic actions (planning, monitoring, and evaluating personal progress against a standard). Students who are motivated to learn the material may develop expected cognitive components which contribute to one's self-regulated learning components and academic progress. This study's finding supports previous efforts of Mega, Ronconi, and De Beni (2014) who emphasized how learners are motivated to learn behaviours that they value and consider relevant to the development of their self-regulated outcomes. It also stands with the views of Vansteenkiste et al. (2012) about the main drivers of self-regulated learning by explaining how incorporating the motivational elements into the design of a courseware can help facilitate students' cognitive reaction. Based on these, it appears that nurses felt motivated to learn with the SL, which also played a key role in promoting their self-regulated outcomes. This result contributes to the

self-regulated theory by explaining how individuals' motivation can help explain individuals' regulation or thinking when engaging in active learning behaviour. It also provides new insights to the needs for considering personal aspects such as motivation when examining the effectiveness of virtual world in a context specific situation.

Limitations and Future Work

This study poses some limitations on our results. For example, the learning cases used in this study were limited to prepare nurses to deal with patients with heart related problems such as 'Trauma Case Treatment' that requires monitoring and record the vital signs of patients. Meanwhile, this study was limited to certain environmental elements where other studies can consider other behavioural presence factors to mediate the effect of SL on nurses' learning. The sample of this study was limited to the nurses who are familiar with SL, meaning that other nurses who have not used SL before may perceive the environmental elements differently than those with previous experience. Thus, future studies may consider examining the potential of SL using more complex scenarios that involve multiple tasks of possibly different types. In addition, future studies can also examine other environmental elements towards certain behavioural and cognitive outcomes.

Conclusion

This study examined the effects of SL on student nurses' confidence and motivation in order to develop their self-regulated learning performance. The study's main contribution is in confirming the effectiveness of SL in the teaching and learning of nursing students at a distance. It provides the necessary evidence of the potential of certain SL elements such as functionality, content design, and interactivity in modulating nurse students' confidence and motivation online. The study revealed that nurses who used SL tended to perceive the environment as sufficient for them to practice medical cases and apply it later in real world settings. Furthermore, this study found that the main factors effecting nurses' motivation and confidence are environment content design, environment interactivity, and environment functionality.

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APPENDIX

QUESTIONNAIRE

Environment content design (ECD)

ECD1	The level of difficulty of the learning contents in the Second Life is appropriate
ECD2	The content of learning scenario is easy to understand in the Second Life environment
ECD3	The amount of learning contents is appropriate in the Second Life environment
ECD4	The delivery schedule of learning contents is flexible in the Second Life environment
ECD5	Second Life provides individualized learning management
ECD6	Second Life provides a variety of learning methods

Environment functionality (EF)

EF1	In Second Life, it is easy to move from one page to another
EF2	This environment has all the functions and capabilities I expect it to have
EF3	The Second Life environment enables me to navigate easily
EF4	Whenever I make a mistake using Second Life, I recover easily and quickly
EF5	Second Life is stable and doesn't crash regularly
EF6	Overall, Second Life reacts quickly to my commands
EF7	Overall, I found this environment to quickly perform statistical computations related to my learning activities

Environment interactivity (EI)

EI1	I would like to share my experience with others in the Second Life environment
EI2	I believe Second Life can assist teacher-learner interaction
EI3	I believe Second Life can assist learner-learner interaction
EI4	The information provided in the Second Life is easy to understand
EI5	The information in the Second Life is effective in helping me complete the tasks and scenarios

EI6	I am satisfied with Second Life
EI7	The organization of information on the Second Life pages is clear
EI8	It is easy to find the information that I need in the Second Life environment

Confidence (CONF)

CONF1	Learning about this environment is easy for me
CONF2	I feel confident that I can learn how to use this environment
CONF3	I feel confident that I can figure out how to use this environment on my own
CONF4	I feel confident that I can select appropriate medical equipment in this environment to use in my learning
CONF5	I feel confident that this environment will help me understand concepts better
CONF6	I feel confident that I can use this environment to meet certain learning goals
CONF7	I feel confident that I can use this environment to communicate with my colleagues

Motivation (MOT)

MOT1	The science I learn in Second Life is relevant to my background
MOT2	I like to do better than other students on nursing in Second Life
MOT3	Learning is interesting with Second Life
MOT4	I put enough effort into learning using Second Life
MOT5	I use strategies to learn well in Second Life
MOT6	Learning by doing in Second Life will help me get a good job
MOT7	I am confident I will do well in Second Life
MOT8	Knowing how to use Second Life will give me a career advantage
MOT9	I spend a lot of time learning in Second Life
MOT10	I am confident I will do well on learning in Second Life
MOT11	I believe that using Second Life can help me master necessary knowledge and skills related on nursing
MOT12	I enjoy learning in Second Life
MOT13	I will use science problem-solving skills in my career

Self-regulated learning (SRL)

SRL1	I set standards for my learning in this environment
SRL2	I keep a high standard for my learning in the Second Life
SRL3	I set goals to help me manage studying time in the Second Life
SRL4	I find Second Life to be a comfortable place to study
SRL5	I can study most efficiently in Second Life
SRL6	I prepare my questions before joining in the chat room and discussion in Second Life
SRL7	I work extra problems in Second Life in addition to the assigned ones to master the learning content
SRL8	I allocate extra studying time in Second Life because I know it is time demanding
SRL9	I find someone who is knowledgeable in Second Life so that I can consult with him or her when I need help
SRL10	I share my problems with my classmates in the Second Life, so we know what we are struggling with and how to solve our problems
SRL11	I summarize my learning in the Second Life to examine my understanding of what I have learned
SRL12	I ask myself a lot of questions about the course material when studying in Second Life

BIOGRAPHIES

Ahmed Isam Al-Hatem has finished his PhD. in virtual reality applications from the Centre for Instructional Technology and Multimedia, Universiti Sains Malaysia. His research interests include creative writing, graphic design, and improving user experiences in healthcare. He is also interested in integrating technology in teaching and learning, specifically of mathematics, effect of cognitive psychology in designing and developing learning environment, and representational systems in different contexts.

Mona Masood is the Deputy Director of Academic, Research and Innovation at the Centre for Instructional Technology and Multimedia, Universiti Sains Malaysia since 2010. Her research interest lies in Eye Tracking research, HCI, and Visual Communication. She was awarded two golds, one silver, and best of the best awards on two separate research products at the national level.

Hosam Al-Samarraie is currently a senior lecturer in the Centre for Instructional Technology and Multimedia of Universiti Sains Malaysia. Hosam's general research areas are in Human Computer Interaction and Higher Education. His research interests include application of Brain Computer Interfaces and eye-tracking to examine users' behavioural changes toward a system design and functionalities. Lately he has focused on approaches of data mining for clustering and predicting users' usage patterns of system in different educational contexts