EFFECT OF STUDENT SATISFACTION ON ELEARNING QUALITY AND LEARNING OUTCOME AMONG MALAYSIAN UNDERGRADUATE NURSING STUDENTS

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ABSTRACT

Elearning has become an important and ubiquitous instructional tool across a broad range of programs in institutions of higher education. This is evident today in nursing education where elearning in a blended approach provides both enormous and flexible opportunities for working nurses to further their education and to engage in continuous professional development for life-long learning. We conducted a pilot study to test the feasibility of participant recruitment, data collection, and online survey in an elearning education program in Malaysia. The conceptual framework developed for the study was based on DeLone and McLean (2003) Information Systems Success Model to examine any mediation effect of student satisfaction on elearning quality and learning outcome among nursing undergraduates in a local elearning program. We used the Partial Least Squares approach to analyze the possible effects on the relationships among the variables studied. The exploration process to determine the feasibility of the preliminary online survey helping to contribute to the main study to be conducted in an elearning nursing context. The findings revealed that there were significant relationships between the dimensions of system quality and service quality with student satisfaction and learning outcome. The results showed that there was a mediating effect of student satisfaction on the relationship between elearning quality and learning outcome. The study emphasizes the importance of an initial understanding of the learning environmental needs of learners to provide a credible and meaningful learning experience for working nurses in elearning nursing programs.

Keywords: elearning quality, learning outcomes, mediation, nurses, student satisfaction

INTRODUCTION

The nursing profession requires nurses to be equipped with the required knowledge, skills, and attitude to integrate nursing practice into healthcare (Sowtali, 2019). The integration of technology in a flexible learning mode has attracted many working adults to enroll in higher education. Similarly, in nursing education, the enrolment in bachelor's degree programs in the elearning mode has been encouraging (Rouleau, 2017). Such opportunities in education not only enhances professional development but also addresses the requirement of lifelong learning needs for nurses. In light of this technological transformation in higher education in the form of the elearning approach, it is important to determine how factors of elearning quality influence student satisfaction and assist in predicting elearning outcomes in nursing undergraduate programs.

In Malaysia, various studies on elearning approaches have been conducted in the health sciences fields such as medical science, biomedical science, nutrition and dietetic, and optometry (Azhari & Ming, 2015). However, there are limited studies on nursing education and thus there is a critical need to examine the possible effects of elearning approaches in the context of local nursing education. Al-Shorbaji et al. (2015) proposed that studies need to be conducted on the outcomes of elearning education among low- and medium-income countries. As such, this fits the context for a study on a medium-income country such as Malaysia.

In their meta-analysis of online learning in nursing education, Voutilainen et al. (2017) asserted that no generalization with regards to elearning can be made to nursing education. Thus far, the direction of the effect of elearning on learning outcome seems broad and varied. They suggested that further studies should investigate factors that may cause variation in learning outcomes among nursing students in online education. Another meta-analysis reported a lack of studies on the effects of elearning in comparison to didactic learning in nursing education (Lahti et al., 2014). Button et al. (2014) concurred with the critical need to evaluate the impact, effectiveness, and user perception of elearning approaches in nursing education.

The Ministry of Higher Education Malaysia (2017) reported that out of a total of 354,673 students enrolled at private higher education institutions, only 119,873 (33%) of the students had successfully graduated within the stipulated program duration. Similarly, the delayed graduation and attrition rate for online undergraduate programs remain high in many countries (Bawa, 2016; Fraser et al., 2018). For example, the literature on nursing education reveals that the attrition rate of nursing students is high, as much as 50% in some nursing bachelor programs (Merkley, 2016; Roos et al., 2016). In Iran, the percentage of prolonged graduation among students in Nursing Science was nearly 20% (Tagharrobi et al., 2013). Tinto (1982) predicted that the dropout rate of students from higher education was at 45% and seemed to have remained constant over the past 100 years. It can be inferred that the challenge to retain students in online learning nursing programs seems to be greater for institutions of higher education.

With the high increase in offerings on elearning for nursing education in Malaysia, it is therefore important to investigate the efficacy of elearning nursing programs in a local context. The preceding reviews on elearning situations in institutions of higher education show an alarming attrition rate and delayed graduation among students enrolled in nursing bachelor programs. In addition, little is known about nursing students' needs and level of satisfaction in elearning or online learning environments. Previous studies account for the need to examine further the relationship of elearning quality and learner satisfaction (Decelle, 2016; Tabari Khomeiran et al., 2006; Zhao, 2016), and how these factors may affect learning outcomes (Kim & Kim, 2015; Pintrich & de Groot, 1990) among working nurses in elearning programs.

It needs to be highlighted that it is uncommon to see publications of pilot studies in journals in the past. But in recent years, an increasing number of pilot or preliminary studies have been published in many nursing and health science related fields (Lancaster, 2015; Morin, 2013). A majority of researchers support the benefits of sharing the findings of pilot or initial studies that could facilitate collaboration projects of similar research areas in other disciplines. The advantages of pilot studies include cost effectiveness in terms of time, human energy, and public resources saving (Eldridge et al., 2016), as well as preventing duplication of efforts (Fraser et al., 2018) and avoiding possible negative impacts on human subjects (Doody & Doody, 2015).

METHOD AND INSTRUMENT

We employed a cross-sectional quantitative survey approach in this pilot study. The collected data were analyzed via correlation analysis and multiple regression analysis using Partial Least Squares (PLS) to investigate the direct and indirect

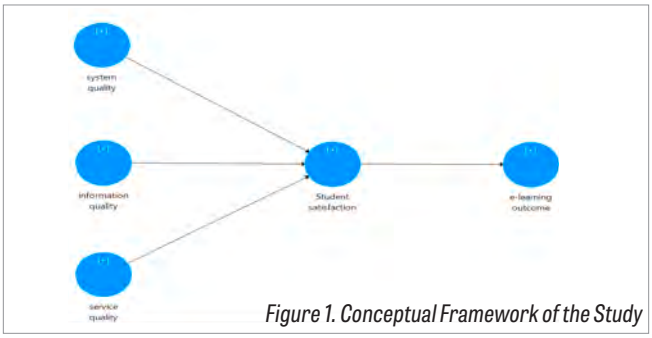

Figure 1. Conceptual Framework of the Study

relationships among the variables of elearning quality, student satisfaction, and elearning outcome in a nursing baccalaureate degree program in Malaysia. The research model depicted in Figure 1 is a conceptual framework developed based on DeLone and McLean Information System Success Model, or D&M IS Success model (DeLone & McLean, 2003), with the main purpose of examining the relationship between elearning quality (comprising system quality, information quality, and service quality) and student learning outcome and also the effect or influence learner satisfaction has on these relationships.

The D&M IS Success model was developed in 1992 and has been used in more than 300 studies to date. From 1993 to 2002, a total of 285 journal papers and 16 empirical studies supported the relationship among the information systems success dimensions of the D&M IS Success model (DeLone & McLean, 2003). In approximately two decades, Marjanovic et al. (2016) reported that the D&M IS Success model has been continuously used as a foundation for numerous studies and was referenced up to 3,164 times. Many researchers attest to the high impact of the quality dimensions in the D&M IS Success model on higher education settings in developing success in elearning (Mahmoodi et al., 2017; Ojo, 2017; Van Cauter et al., 2017).

The original D&M IS Success model initiated in 1992 consists of six dimensions: (a) quality of the system, (b) quality of the information, (c) use of the system, (d) user satisfaction, (e) individual impact, and (f) organizational impact (DeLone & McLean, 2003). The D&M IS Success model is widely used to assess the success of ecommerce systems in respect to customers' and providers' perspectives. It was then revised by DeLone and McLean in 2003 to address aspects in trainer and user perspectives and variances in cultural beliefs. The six original dimensions were retained adding the dimension "intention to use" to the system and replacing the "individual impact" and "organizational impact" dimensions with "net benefits." In the past decade, various evidence supports the credibility of the D&M IS Success model in the adoption of its multidependent measures. The D&M IS Success model has been modified by other researchers to evaluate online learning systems at the program level that facilitate learning, course content delivery, communication, and online-based activities. The model has been validated and is widely used in numerous studies related to information systems. Various studies support the use of the constructs of D&M IS Success model as an effective applicable framework to investigate the success of information systems in hospitals (Bossen et al., 2013; Cho et al., 2015), learning management systems in universities (Ajoye & Nwagwu, 2014; Lin, 2017), and virtual education systems involving elearning or online learning (Chuo et al., 2015; Holsapple & Lee-Post, 2006; Mahmoodi et al., 2017).

In the model we developed for this study, the dependent variable elearning outcome, or net benefit, is the outcome concept displayed on the right side of the model. This variable is identified as the extent to which the elearning program contributes to the success of learners in achieving individual learning outcomes. To the left of the model, elearning quality (system quality, information quality, and service quality) is connected to student satisfaction by a one-way arrow indicating its direct effect on the student satisfaction variable.

System quality refers to the desired characteristics of the elearning system at a technical level that comprise the utility features of the system such as easy-to-use, user friendly, stable, secure, fast, and interactive. The second feature of elearning quality is information quality, which is defined as the desired characteristic outputs of an elearning system such as the systematic organization of course information and effective presentation of the right length that is clearly written, useful, and up to date. Service quality refers to the desirable characteristics of student-faculty interactions such as promptness, responsiveness, fairness, knowledgeability, and faculty availability. Finally, user satisfaction (or student satisfaction) relates to the level of satisfaction perceived by the learners using the elearning system. The focus of our study is therefore the relationship among elearning quality (system quality, information quality, and service quality), student satisfaction (user satisfaction), and elearning outcome (net benefit on individual impact). The study examined perceived satisfaction of the elearning system from the perspective of the undergraduate nursing students. The nature or frequency of the usage dimension is excluded as a variable of study because use of the elearning system is mandatory for all students enrolled in the

elearning nursing program.

Based on the conceptual framework of the study, the direct influence between elearning quality (system quality, information quality, and service quality) and student satisfaction and between student satisfaction and elearning outcome were measured. Student satisfaction is identified as a mediator variable that may influence the relationship between elearning quality and elearning outcome. The following are the hypotheses posited for the study:

Ha1: There is a statistically significant effect of system quality on student satisfaction.

Ha2: There is a statistically significant effect of information quality on student satisfaction.

Ha3: There is a statistically significant effect of service quality on student satisfaction.

Ha4: There is a statistically significant effect of student satisfaction on elearning outcome.

Ha5: Student satisfaction is a mediating variable in the relationship between system quality and elearning outcome

Ha6: Student satisfaction is a mediating variable in the relationship between information quality and elearning outcome.

Ha7: Student satisfaction is a mediating variable in the relationship between service quality and elearning outcome.

A sample of 30 subjects from a local private university were selected for the pilot study. The subjects were full-time nursing students in an elearning 2-year undergraduate nursing program (RN-BSN nursing candidates). The recommended minimum sample size for pilot studies is 12 subjects within a single center, which allows for estimating average values and variability while providing valuable preliminary information for subsequent studies (Moore et al., 2011). In addition to the preliminary findings, the main focus of the pilot study was on the feasibility of recruiting participants, the data collection procedure involving an online survey process, and determining the internal reliability of the instrument for the main study. Hence, power calculation and confidence intervals for sample size were not considered in the pilot study.

Based on the principles of the D&M IS Success model, we adapted a self-administered questionnaire based on the elearning success model (Holsapple & Lee-Post, 2006) with permission from the researchers. The elearning course evaluation survey consists of 25 items on a 5-point Likert scale ranging from strongly agree to strongly disagree. The overall rating for each dimension was calculated by averaging the participants' ratings on the corresponding items of the survey. A mean score of the average ratings for each dimension was then expressed in percentage form to indicate the highest perception of success rating possible for the dimension.

A panel of six content experts, including four nursing faculty who were involved in elearning teaching and another two elearning support staff, were selected to evaluate the item relevancy of the elearning success questionnaire using the Content Validity Index (CVI). The results of the I-CVI score ranged from 0.83 to 1.00 for each item validating the relevancy of the tool for the study (Polit & Beck, 2006). Minor amendments for a few identified items in the elearning Course Evaluation Survey were conducted based on the comments provided by the panel of experts to ensure the clarity of the items for respondents. The internal consistency index obtained for the elearning Course Evaluation Survey was at Cronbach's Alpha 0.942. A reliability score of 0.80 or higher is considered a strong internal consistency coefficient for a survey questionnaire (Grove et al., 2015; Grove & Gray, 2018). As a result, no revisions were made for the main study instrument.

RESULTS AND DISCUSSION

To analyze the data, we employed the partial least squares structural equation modeling (PLS-SEM) approach via the SmartPLS version 3.0 software. PLS-SEM is a variance-based approach used to predict the relationships among constructs and to explore the mediating effect on the relationship between constructs (Hair et al., 2011). Table 1 displays the factor loadings and average variance extracted (AVE) to evaluate the convergent validity and composite reliability (CR) of the reflective constructs (system quality, information quality, service quality, student satisfaction, and elearning outcome).

According to the PLS algorithm, since the indicator loadings exceed the recommended values of 0.70, all the items (See Figure 2) were retained

(Hair et al., 2017). Similarly, all the constructs met the threshold values for CR (> 0.7) and AVE (> 0.5). The discriminant validity of the model was also assessed using Fornell and Larcker and the Heterotrait-Monotrait (HTMT) criterion. Based on the Fornell and Larcker (1981) assessment, all constructs of the model exhibited sufficient discriminant validity in which the square root of AVE was greater than the correlations for all reflective constructs. In addition, the HTMT results showed that all the values fulfilled the criterion of less than 0.90 (Gold et al., 2001). These findings show that the five constructs met the internal consistency and convergent and discriminant validity requirements for the study. These findings are consistent with past literature based on the DeLone and McLean model (Holsapple & Lee-Post, 2006; Lee-Post, 2009; Ojo, 2017).

Table 1. Measurement Model for the Effect of Student Satisfaction on the Relationship Between eLearning Quality and eLearning Outcome

Construct	Items	Loadings	Cronbach's alpha	AVE	CR
System quality	E1	0.953	0.943	0.785	0.956
	E2	0.951			
	E3	0.908			
	E4	0.799			
	E5	0.758			
	E6	0.928			
Information quality	E7	0.877	0.959	0.831	0.967
	E8	0.932			
	E9	0.951			
	E10	0.931			
	E11	0.902			
	E12	0.875			
Service quality	E13	0.782	0.891	0.697	0.920
	E14	0.898			
	E15	0.852			
	E16	0.837			
	E17	0.801			
Student satisfaction	E18	0.890	0.952	0.874	0.965
	E19	0.947			
	E20	0.950			
	E21	0.951			
eLearning outcome	E22	0.902	0.894	0.762	0.927
	E23	0.772			
	E24	0.902			
	E25	0.907			

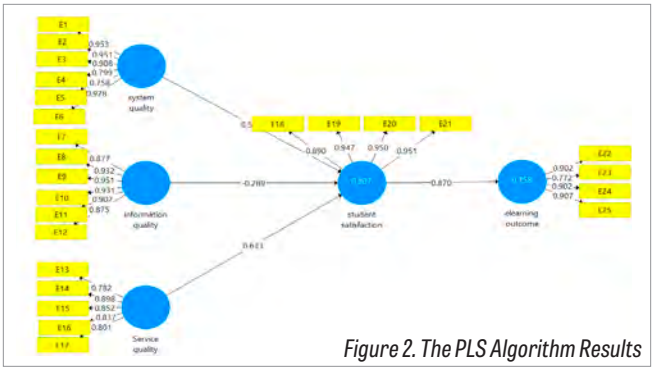

Figure 2. The PLS Algorithm Results

In Table 2, three out of four relationships were found to have a t-value of ≥ 2.647 at 0.05 level of significance. The predictors of system quality ($\beta = 0.564$, $p < 0.05$) and service quality ($\beta = 0.633$, $p < 0.01$) were positively related with student satisfaction and explained 80.7% of the variance in student satisfaction. In addition, the influence of student satisfaction ($\beta = 0.87$, $p < 0.05$) on elearning outcome indicated that student satisfaction is positively correlated with elearning outcome and explains 75.8% of the variance in elearning outcome. The R2 value of 0.758, which is above the 0.75 value as recommended by Hair et al. (2019), indicates a substantial model. It was observed that service quality (0.761) and system quality (0.592) showed a large effect and moderate effect respectively in producing the R2 for student satisfaction (0.807).

On the other hand, information quality did not show a significant effect ($p > .05$). Therefore, H1, H3, and H4, but not H2, are supported. The findings are congruent with past studies where system quality (Delone & McLean, 2003; Eom, 2012; Holsapple & Lee-Post, 2006) and service quality (Delone & McLean, 2003; Holsapple & Lee-Post, 2006) are each significantly related to student satisfaction. The study highlighted the importance of elearning system support in terms of its usability, feasibility, and effectiveness in using the system and the pivotal roles of facilitators in learning. Interaction between facilitator-student and peer support are factors that contribute to elearning success. This study, however, was unable to demonstrate a significant link between information quality and student satisfaction. The findings on the nonsignificant effect of information quality on student satisfaction

Table 2. Hypothesis Testing for the Relationship of System Quality, Information Quality, and Service Quality on Student Satisfaction and eLearning Outcome

Hypothesis	Relationship	Std. Beta	Std. Error	t-values	Decision	R2	f2	Q2	q2
H1	System quality → student satisfaction	0.564	0.516	2.647*	Supported	0.807	0.592	0.570	0.260
H2	Information quality → student satisfaction	-0.289	-0.288	1.658	Not supported	-	-	-	-
H3	Service quality → student satisfaction	0.633	0.652	4.609**	Supported	0.807	0.761	0.570	0.260
H4	Student satisfaction → elearning outcome	0.870	0.851	10.697*	Supported	0.758	3.124	0.445	0.445

Note: **p<0.01, *p<0.05

do not seem to support the findings from other studies (Delone & McLean, 2003; Eom, 2012; Holsapple & Lee-Pos, 2006; Wu & Wang, 2006). This could be explained by the different needs and expectations of nursing graduates who are from diverse cultural and educational backgrounds in Malaysia compared to other developed countries. The amount and depth of information or resources required may be influenced by the degree of self-regulated behavior of the students. To address this, the faculty could design instructional methods incorporating resources that help stimulate learners to adopt self-regulated learning and be independent to explore new resources to support their studies.

Furthermore, the predictive relevance of the model was examined using the blindfolding procedure. The Q2 values for student satisfaction (0.570) and elearning outcome (0.445) were greater than 0.35, indicating that the model has a large predictive power of the endogenous construct. Also, the q2 effect size (0.260) for both system quality and service quality were moderate, while student satisfaction (0.445) was shown to have a substantial q2 effect size to the endogenous construct in the structural model (Hair et al., 2011). These indicate that system quality and service quality have a medium relative predictive relevance for student satisfaction, whereas student satisfaction shows a large relative predictive relevance for elearning outcome. In conclusion, the findings of the study suggest that the influence in relationships among system quality, service quality, and student satisfaction are accurate predictors of the model.

To address hypotheses H5, H6, and H7, we conducted mediation analysis using bootstrapping analysis. Table 3 depicts the indirect effects (β = 0.490 and β = 0.551) and significant at t-values of 2.647 and 4.609. The indirect effects 95% Boot Confidence Interval Bias Corrected: (LL = 0.117, UL = 0.861) and (LL = 0.343, UL = 0.787), which does not include a zero in between the values and indicates a mediation effect in the model (Preacher & Hayes, 2008).

Based on the results, we found that the mediation effect of student satisfaction on the relationship between system quality and service quality on elearning outcome was statistically significant. Hence, H5 and H7 are supported but not H6. The findings are consistent with DeLone and McLean (2003) and Lee and Lee (2008) on the significant mediating effect of user satisfaction on the relationship between system quality and net

Table 3. Hypothesis Testing on Mediating Effect for the Relationship Between System Quality, Information Quality, and Service Quality on eLearning Outcome

Hypothesis	Relationship	Std. Beta	Std. Error	t-values	Confidence Interval (BC) LL UL		Decision
H5	System quality → student satisfaction → elearning outcome	0.490	0.449	2.647*	0.117	0.861	Supported
H6	Information quality → student satisfaction → elearning outcome	-0.251	-0.243	1.658	-0.562	0.057	Not supported
H7	Service quality → student satisfaction → elearning outcome	0.551	0.553	4.609*	0.343	0.787	Supported

Note: *p<0.05, **p<0.01, BC=Bias Corrected, UL=Upper Level, LL=Lower Level

benefits (elearning outcome). These results suggest that student satisfaction is a mediator between the influence of service quality and system quality on learning outcome. This indicates that elearning quality could improve perception in achieving better learning outcomes when satisfaction is increased. Most students recognize the quality of elearning tools and the prompt response and feedback from facilitators. Therefore, it is essential to improve on the features and functions of the elearning platform and to further strengthen the interaction and communication between faculty and student through elearning education. However, the results contradict the findings of Petter et al. (2013), who found that information quality is a key predictor of net benefits through mediating effect of student satisfaction. A final structural model for the study is presented in Figure 3.

As tested in the pilot study, the online survey was able to access participants and was convenient for data collection within a short period of time that involves a large sample size from different geographic areas. Information and data collected were automatically transformed to a spreadsheet similar to an Excel document. The data were then transferred directly to SPSS software followed by Smart PLS software for data analysis.

Based on the pilot study process, three incomplete surveys on demographic data were received. Three participants did not indicate their age and two others did not respond to the CGPA score. In view of these, all items for the main study will be set to a compulsory mode for respondents before they could proceed to the next section. This is to ensure that all data collected will be complete without any missing information.

CONCLUSION

This preliminary study found that elearning quality (system quality and service quality) correlated with student satisfaction (user satisfaction) and indirectly influenced elearning outcome (net benefit) through a mediator variable (user satisfaction). The findings revealed that quality related to system and service support in an elearning environment can have an influential effect on user satisfaction among nursing undergraduates. This in turn, can lead to greater success for students in their undergraduate studies. Student satisfaction is also reported as a significant mediator in the relationship between system quality and service quality and elearning outcome.

The pilot study demonstrated the feasibility of the study in elearning nursing education context through an online survey. It is also evident that the D&M IS Success model is an effective framework to determine the quality factors that could impact student satisfaction and eventually learning outcomes. The pilot study and sharing of its process and outcomes can contribute to strengthening the main study regardless of the disciplines of the study. In the near future, we plan to explore further an extended D&M model with other possible predictors that may positively influence student satisfaction and elearning outcomes among working nursing students in Malaysia.

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DECLARATION OF INTEREST STATEMENT

We declare that we have no financial or personal relationship(s) that may have inappropriately influenced us in writing this article.

CONTRIBUTION OF AUTHORS

The main author, Chang Woan Ching, was involved in designing the study, acquiring and analyzing the data, and drafting the manuscript, while the second author, Professor Dr Nooreiny Maarof was involved in critical analysis, evaluation, and revision of the intellectual content of the manuscript and its overall presentation.

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