Investigating the Quality of e-Learning Technology in Relation to Outcomes

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Abstract: The advent of technology has injected a paradigm shift in teaching and learning. The consequence of the association towards students perception of quality and e-Learning environment has been evaluated but with contradictory results. This question was addressed by surveying 530 students about their perceptions of the e-Learning environment quality in terms of technology. Path analysis was used to investigate how students' perception of quality is related to their e-learning outcomes in term of learning success, satisfaction and use. This method is used because it is a straightforward extension of multiple regressions that provide estimates of the magnitude and significance of hypothesized connections between sets of variables. With regard to their learning success and use, the technology quality is significantly related to the e-Learning outcomes. However, the same could not be said for the student's satisfaction. The results of the study suggest influencing students' perception and goals by adapting openness and having clear objectives among actors of the e-Learning environment.

Key words: Technology quality, e-Learning, outcomes, sustainability, Malaysia

INTRODUCTION

e-Learning has become a popular learning approach in higher educational institutions due to the vast growth of internet technology in Malaysia. Prior research has shown that educational institutions often face challenges while developing, managing and continuously improving the e-Learning environment. One challenge comes in the form of finding an equilibrium between technological advancements and pedagogical standards. Hence, e-learning which evolved from the need to provide learning between instructor and student separated by space or time should be sustainable enough to act as the building block for both present and future learning (Heverly, 2008).

The National Committee of Inquiry into Higher Education defines sustainable e-Learning as e-Learning that adopts technology and reduces unit costs while maintaining teaching quality (Stepanyan *et al.*, 2013). One way of determining either e-Learning is an important mechanism of sustainable development is through the students' perception. Accordingly, perception is defined as the individual's own criteria and perspective (Sahin and Shelley, 2008).

Technology is a term used to denote the making, usage and knowledge of tools, machines, techniques, crafts, systems or methods of organization in order to solve a problem or perform a specific function. In the context of this study, technology refers to the Information and Communication Technology (ICT) related factors regarding e-Learning environment which is generally linked to the infrastructure planning and the capability of both the hardware and software available to the learning environment.

e-Learning technologies may offer benefits such as reduced education cost, consistency, timely content, flexible accessibility and convenience. However, the development of such technologies in the educational world faces numerous challenges such as the multiplicity of available e-Learning tools and the various teaching domains requiring diverse approaches. These problems in the development of e-Learning environment require the actors to share their experiences by favoring collaboration and exchanges. As such, the e-Learning environments need to be able to support different learning approaches such as formal, informal, personal and social for a sustainable development.

The social aspect of the learning process depends on human interaction. This aspect is denoted as a learning act guided by regular contacts and associations with peers. In addition, social learning is also regarded as the process in which individuals observe the behavior of others and its consequences and modify their own behavior accordingly (Bandura, 1977).

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There are five aspects of sustainability in e-Learning practices; sustainability of learning platforms and learning software, sustainability of institutional responses to the use of e-Learning, sustainability of e-Learning materials development, sustainability of pedagogic approaches and sustainability of teacher and trainer skills.

Theoretical background : The study adopts the Social Cognitive Theory (SCT) as the main theory. SCT provides a framework to understand human behavior as an interaction between personal factors, the environment and, behavior (Bandura, 1977). SCT is also recognized for proving individual behavior. Bandura (1986), mentioned triadic reciprocity as a process by which learners act with the agency and their behaviors were influenced by internal factors and stimuli they experience in their environment (Bandura, 1986).

SCT is appropriate to this study for several reasons. First, the social cognitive theory has a unique theoretical strength when used in studying the learning process. According to Merriam and Caffarella (1999), SCT focuses more on the cognitive processes involved in learning. Second, the SCT argues that learning occurs within a social context. Although, the theory also emphasizes the learning process, the theory is more focused on an individual's internal mental processes such as perceiving, comprehending and storing information that is under the learner's control but less on external and contextual factors that are not controlled by learners. Therefore, when studying the learning process in Higher Education Institution (HEI), the social cognitive approach is more appropriate because it highlights the social dimensions of learning and has been shown to be relevant to both formal classroom and informal workplace contexts.

Third, the social cognitive theory is well accepted for its ability to explain individual behavior. It proposes a model of triadic reciprocity where behavior, cognitive and other personal factors and environmental all serves as interrelated determinants (Bandura, 1986). When investigating learners and their learning processes, SCT describes what happens to the students while they are learning such as how a learner behave, their cognitions and also what values are affected, therefore, helped to capture the complexities involved in the learning process. Fourth, SCT has been empirically validated and frequently used in Information System (IS) research. Furthermore, SCT has been used in research on individual technology adoption and user acceptance, technical support Information Technology (IT), training, e-Learning and recently in e-Learning environment.

Related problems and issues: Following prior researchers, the study investigates the perception of quality as the individual factor with a focus on learning outcomes in e-Learning. The reason is because e-Learning outcomes such as satisfaction and learning success are the ultimate goals to be obtained by students' in learning environments. Prior studies has shown that perception towards technology quality was a significant determinant of user performance of e-Learning environment. Thus, if students believe the technology embedded in their e-Learning environment will be reliable, available and easy to use, therefore they will be using it more frequently. Scholars showed that perception of service quality has significantly predicted user satisfaction of e-Learning environment. Although, satisfaction and learning success are mentioned to be correlated but researchers showed that learners who are successful in their learning process may still feel unsatisfied. In order to find out whether students' perception of technology quality in e-Learning environment have different influences on their satisfaction and their learning success, therefore, the study focuses on the following hypothesis:

- H_{1a}: perception of technology quality has a positive effect on learning success in e-Learning environments
- H_{1b}: perception of technology quality has a positive effect on satisfaction in e-Learning environments

From an e-Learning perspective, the perception of technology quality is measured in terms of both the hardware and the various software applications available. As for the relationship between perception of technology quality and e-Learning use, some studies confirmed a direct relationship between perception of technology quality and decision-making performance, job effectiveness and quality of work. Thus, the study also hypothesizes the following:

- H_2: students who have a higher perception of technology quality will have a higher level of e-Learning use

MATERIALS AND METHODS

The research adopted a quantitative method by using the survey to collect data. The survey comprises of both online survey and paper-based survey which were distributed to students of a university in Malaysia. The study focuses on this specific institution in order to minimize the variation among HEIs due to the use of different e-Learning environments. Therefore, taking all

institutions as one population will dilute the resulting effect of main constructs in the study. Purposive sampling method was used to choose the students. Only second and third-semester students were involved in this study. This is done to ensure homogeneity of samples and also because these students have the required experience to make a general perception on the quality of their e-Learning environment. In making a decision on appropriate sample size, the study considers both statistical accuracy and cost. For Maximum Likelihood Estimation (MLE), the acceptable minimum sample size to ensure appropriate use of MLE is 100-150 (Ding *et al.*, 1995).

For this study, the sample population consisted of 530 students and their majors included Islamic Studies, Linguistic, Computer Science, Multimedia, Management and Communications. In terms of the academic levels of the participating students in this study, 70.6% of students were from the second semester and 29.4% were third-semester students. At 62.8% of the total, the majority of the participants were female with 37.2% males. Regarding the students' e-Learning experiences, 4.5% of the participating students answered that this was their first e-Learning course and 43.2% of students answered that they had taken at least five e-Learning courses, including this course.

The survey items were then analyzed using factor analysis. The survey comprised of seven sections namely: demographic, perceptions of technology quality, perceptions of course content quality, perceptions of support service quality, e-Learning use, learning success and satisfaction. However, this study will mainly focus on the perception of technology quality section to determine students' perspectives toward technology quality. In total, the survey consists of 31 close-ended questions. All items (except for the demographic section) will be measured on a Likert scale from 1 (strongly disagree) to 7 (strongly agree). The 7-point Likert scale has been widely used in e-Learning studies. Students are asked to select between numbers from 1-7 to indicate their level of agreement on a specific statement.

Before conducting the multivariate data analysis assumptions of multivariate data analysis was tested. The scale of variables, the size of sample, their multivariate normal distribution, their multicollinearity and outliers are the assumptions that need to be fulfilled (Hair *et al.*, 2010). Furthermore, the correlation among the independent variables is <0.9 suggesting no multicollinearity problem As far as multivariate normal distribution is concerned, the skewness and kurtosis ($<\pm1$) and the standardized residual ($<\pm2.5$) indicating that there was no serious violation. Therefore, it can be suggested that the basic assumptions of multivariate analysis were fulfilled.

RESULTS AND DISCUSSION

Table 1 shows the result of assessment of items for the perception of technology quality section and the e-Learning outcomes sections. Based on the means in Table 1, the averages of all the constructs were >5 which indicated that most of the participants were in agreement of the constructs being studied. Confirmatory Factor Analysis (CFA) was then used to test whether the constructs possessed sufficient validity and reliability. All the Cronbach reliability coefficients were higher than the permitted score of 0.7 (Nunnally and Bernstein, 1994). Factor loadings for all items were significant at p<0.05. In addition, the AVE also exceeds 0.5. Therefore, all measures show adequate reliability.

The ratio of the Chi-square value to degrees of freedom (χ^2/df), Root Mean Square Error of Aproximation (RMSEA) and the Comparative Fit Index (CFI) are three measures that were used to estimate the measurement model fit and structural model fit as advised by Mueller and Hancock (2008) the measurement model of this study fit well since RMSEA = 0.051 < 0.08, CFI = 0.964 >0 .90 and χ^2/df <3. The structural model was also fit as χ^2/df was 2.510, the CFI = 0.966 and RMSEA = 0.053. Therefore, it can be suggested that both the measurement and structural model has a good fit with the data collected.

Path analysis was used to investigate how students' perception of quality is related to their e-Learning outcomes in term of learning success, satisfaction and use. This method is used because it is a straightforward extension of multiple regressions that provide estimates of the magnitude and significance of hypothesized connections between sets of variables. As shown in Table 2, the perception of technology quality shows a significant and direct positive influence on students' learning success (p<0.05), supporting hypothesis 1a. The finding supports the underlying assumption in this study that a better quality of

Table 1: Assessment of items

Variables (item)	Mean	Standard deviation	Cronbach alpha	AVE
POT (3)	5.833	0.648	0.816	0.652
ELU (3)	5.989	0.692	0.749	0.553
SAT (3)	5.778	0.765	0.840	0.743
LES (3)	5.745	0.682	0.798	0.615

POT = Perception of Technology Quality; ELU = e-Learning Use; LES = Learning Success; SAT = Satisfaction; AVE = Average Variance Extracted

Table 2: Path analysis of the hypothesis

Hypothesis	Beta estimate	Standard error	Significant value
H_{1a}	0.258	0.059	0.001
H_{1b}	0.095	0.082	0.247
H_2	0.437	0.051	0.001

technological experience makes students more confident and be more successful in overcoming their learning tasks as mentioned in prior studies.

However, the perception of technology quality did not show a significant and direct positive influence on students' satisfaction (p>0.05). Thus, hypothesis 1b is not supported. In comparison to prior studies, the finding was in tandem with result. One explanation for this non-significant result was 95.5% of the respondents involved in the study were experienced e-Learning environment users which have utilized the e-Learning environment for at least one course prior to the study. As the students gained more positive experience by not experiencing any technical difficulties or having poor connection quality during the learning process, the concern on the perception of technological quality may no longer be an issue as such, it did not impact the students' satisfaction level significantly.

Table 2 also shows that the perception of technology quality has a significant and direct positive influence on students' e-Learning use (p<0.05), supporting hypothesis 2. Although, several researchers (33.34) wrote about the concern for a digital divide and inequality among access for students in Malaysia, the scenario is not the issue here as students indicated that there was no difficulty accessing the Internet or using the necessary technology. The current technological advancements available in the learning process might be the solution. As a result, students can acquire a device at a fraction of the cost from even a decade ago with ease. Coupled with the increased functionality of smartphones and expanded data plans make it possible for these students to access contents from a variety of devices. Additionally because a significant number of students resided on campus, they had 24/7 access to computer labs or wireless connectivity which added an explanation to the finding.

CONCLUSION

The study builds on the assumption that students are the focal point of our education system and have the power to change the landscape of the e-Learning environment being utilized in HEIs. As such, a greater understanding of students' perception of quality does play a significant part in increasing the students' adoption of the e-Learning environment especially as the perception of quality from the students' view are scarce and was not sufficiently reported.

However, satisfaction did not contribute in the evaluation of technological quality. Consequently, this showed that the students were unsatisfied with the overall e-Learning environment because they did not have a comprehensive understanding of digital media and were unable to have a clear distinction between learning and play while using the e-Learning environment.

Students could feel unsatisfied from negative incidents in using the e-Learning environment. For example Gil (2008) reported that negative incidents which originated from the lack of technological quality in terms of administration, functionality, instruction and interaction could influence the students' satisfaction. In this regard, one explanation is that unsatisfied students might be experiencing either one of these negative incidents while using the e-Learning environment. From the commercial standpoint, students are similar to customers whose learning needs should be met. Alternatively, from a learning standpoint, optimum learning could not be obtained if the students feel the existence of environmental barriers which prevents them from achieving their objectives. Therefore, further studies are suggested to explore the mentioned demoting negative incidents.

Consequently, the study confirms two things; informal learning is becoming a significant aspect of our learning experience and technology is altering the way we think. With the use of e-Learning environment, formal education no longer comprises the majority of our learning. As such, learning now occurs in a variety of ways; communities of practice, personal networks and also by the completion of related tasks. These various learning ways have been well utilized and has significantly influenced the learning success of students.

One limitation in the overall explanations is the SCT as many other learning theories is only concerned with the process of learning of an individual and not the value of what is being learned. Therefore, it is hard to justify the students' dissatisfaction in the e-Learning environment. Finally, the process of switching from face-to-face teaching to e-Learning is a big change for many HEIs. Based upon the result, two simple guidelines to ensure the success of sustainably using the e-Learning environment is by embedding the feeling of openness among the actors and to set clear objectives at all levels which would ensure the development process runs smoothly thus ensuring that all the actors will benefit from the e-Learning environment.

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