IMPACT OF QUALITY ANTECEDENTS ON SATISFACTION TOWARD MOOC

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ABSTRACT

Literature emphasized the importance of quality antecedents on the successful implementation of MOOCs. However, rare studies are available on how to examine the quality antecedents in the MOOC context. Thus, the objective of this study is to assess the impact of quality antecedents on satisfaction toward MOOC. This study is mainly quantitative, adopted the D&M IS Success Model to examine the relationships between quality antecedents (i.e. system quality, information quality, service quality) and satisfaction toward MOOC. An online survey method was used to collect data from 1000 undergraduate students from five universities in Malaysia; 622 questionnaires were returned for a response rate of 62.2 percent. The questionnaire comprised of two parts. Part1 collected the demographic data, part2 elicited data related to satisfaction and quality antecedents. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) technique. The results partially supported the effect of the quality antecedents on learner satisfaction toward MOOC. There was full support for the relationship between system quality and learner satisfaction toward MOOC. The findings provided by the study have significant practical and theoretical implications about the implementation of MOOC successfully.

Keywords: Massive open online courses, MOOC, satisfaction, quality antecedents.

INTRODUCTION

Massive Open Online Courses (MOOC) are a new trend in e-learning that include a set of learning activities, video lectures, resources, web-based, and forums that can be accessed for free-of-charge and with no prerequisites by a huge number of interested learners around the world (Alraimi, Zo, & Ciganek, 2015). MOOC gained a wide acceptance from high-profile universities due to its significant contribution to improving the educational system quality and openness (Nagashima, 2014). For example, Harvard and

Stanford have shown strong attention to MOOC and were among the early providers of MOOC initiative (Kovanovic, Joksimovic, Gasevic, Siemens, & Hatala, 2015).

Despite the potential of MOOCs to provide high quality, low-cost education, and the ability to increase access to higher-education learning (Albelbisi, Yusop, & Salleh, 2018), a huge number of learners do not complete MOOC courses. The completion rate in MOOC is not exceeding ten percent (Alraimi et al., 2015).

The discrepancy between the enrollment and the dropout rates in MOOC suggests that learning via MOOC presents unique challenges (Liyanagunawardena, Lundqvist, Mitchell, Warburton, & Williams, 2019; Rai & Chunrao, 2016). Kovanovic et al. (2015) highlighted that the high dropout rates in MOOC indicate the need for determining the factors that influence success in MOOC. Thus, issues associated with MOOC successful such as courses, services, and quality should be examined (Azevedo & Marques, 2017; Aparicio, Oliveira, Bacao, & Painho, 2019).

MOOC quality considers one of the most critical factors influencing MOOC success (Azevedo & Marques, 2017), however, there is insufficient literature investigating the quality factors that influence MOOC success (Albelbisi, 2019). For example, Gamage, Fernando, and Perera (2015) have examined 4745 peer-reviewed papers conducted from 2012 to 2015 to determine the factors that impact MOOC quality. The results revealed that only 7 papers provided models for the factors influencing the quality of MOOCs and only three publications provided empirical evidence regarding evaluating MOOC quality. Thus, more research is needed to fully understand the MOOC quality issue that leads to the successful implementation of MOOC.

Evaluating MOOC learning needs new measures of success that reflect the quality of systems and participant's intentions (Yang, Shao, Liu, & Liu, 2017). Thus, this study attempts to fill this knowledge gap by adapting the D&M IS Success Model (2003) to evaluate the quality antecedents of MOOC.

Aim of the Study

This study aims to investigate the influence of the quality antecedents on learner satisfaction toward MOOC. This study adapted D&M IS Success Model (2003) to examine the relationships between the quality antecedents (system quality, information quality, service quality) and satisfaction toward MOOC.

Significance of the Study

The significance of this study is provided empirical evidence and theoretical basis that explain the effect of the quality antecedents on satisfaction toward MOOC. The findings of this study should guide MOOC's instructors, scholars, and designers to develop effective MOOC environments that improve learner's satisfaction toward MOOC. This study also adds to the body of literature by empirically validating D&M IS Success Model (2003) in the MOOC context.

LITERATURE REVIEW

System Quality, Information Quality, and Service Quality

Literature has emphasized the importance of evaluating the factors that influence the success of MOOCs as it provides critical information for stakeholders and scholars to implement of MOOC efficiently (Yang et al., 2017). One of these factors is MOOC quality that should be seen as a key factor influencing MOOC success (Albelbisi, 2019; Aparicio et al., 2019; Liyanagunawardena et al., 2019).

Yang et al. (2017) investigated the factors that influencing learner continuation in using MOOC, the finding revealed that the factors that impact learner continuance in using MOOC are: (1) system quality, this factor measured the reliability and functionality of the MOOC, (2) course quality, this factor defined by the quality and up-to-date of course content, (3) service quality, refers to the support offers from the MOOC providers such as instructors and IT staff, (4) learner perception about ease of use MOOC; and (5) learner perception about the usefulness of MOOC.

Fianu, Blewett, Ampong, and Ofori (2018) also examined the factors that impact the adoption and use of MOOCs on students (N= 204). The findings indicated that continuance intention to use MOOC is affected by system quality, computer self-efficacy, and performance expectancy. Their findings exposed that actual use of MOOC can be determined by instructional quality; this factor represents the quality of MOOC information as well as student's perception of the competence of MOOC instructors.

This study examines the influence of the quality antecedents (system quality, information quality, service quality) on learner satisfaction toward MOOC. Examining such variables is due to the importance of these variables in the MOOC environment (Albelbisi, 2019; Aparicio et al., 2019; Rai & Chunrao, 2016).

System quality factor refers to the quality of the features of the system, it operationalized based on aspects such as ease of use and learn the system, features, accuracy, flexibility, and integrity of the system (Albelbisi, 2020; Yakubu & Dasuki, 2018).

Information quality refers to measure the quality and relevance of the information that the system produced; it is the measurement of system output (Albelbisi, 2019). Information quality measures by aspects such as usability, understandability, importance, availability, and conciseness of the system (Albelbisi, 2020; Yakubu & Dasuki, 2018). The information system is a determinant of learner satisfaction in MOOC settings (Drake, O'Hara, & Seeman, 2015; Yepes-Baldo et al., 2016).

Service quality refers to the levels of the services that are provided by the system, it represents the instructor and institutional support (Albelbisi & Yusop, 2019). Many studies have indicated that service quality significantly impacts user satisfaction in the e-learning context (Mohammadi, 2015; Yakubu & Dasuki, 2018).

Satisfaction

Satisfaction factor has achieved great attention in MOOC literature (e.g., Gameel, 2017; Gutierrez-Santiuste, Gamiz-Sanchez, & Gutierrez-Perez, 2015). Satisfaction is defined as users' level of gratification with the systems, in other words, satisfaction is the user's perception of being satisfied with the system (Albelbisi, 2020).

There is a mounting consensus on the influence of satisfaction on the success of MOOC (Albelbisi, 2020; Aparicio et al., 2019). Understanding the satisfaction of learners toward MOOC has become increasingly important due to the effect of this factor on the use and adoption of MOOC (Kevan, Menchaca, & Hoffman, 2016).

THEORETICAL FRAMEWORK

D&M IS Success Model (2003) has been adopted because it fulfills the objective of this study, which is to examine the influence of quality antecedents on satisfaction toward MOOC. D&M IS Success Model hypothesized that information quality (IQ), system quality (SQ), and service quality (SRQ) factors influencing satisfaction and systems use/intention to use positively. D&M IS Success Model (2003) is displayed in Figure 1.
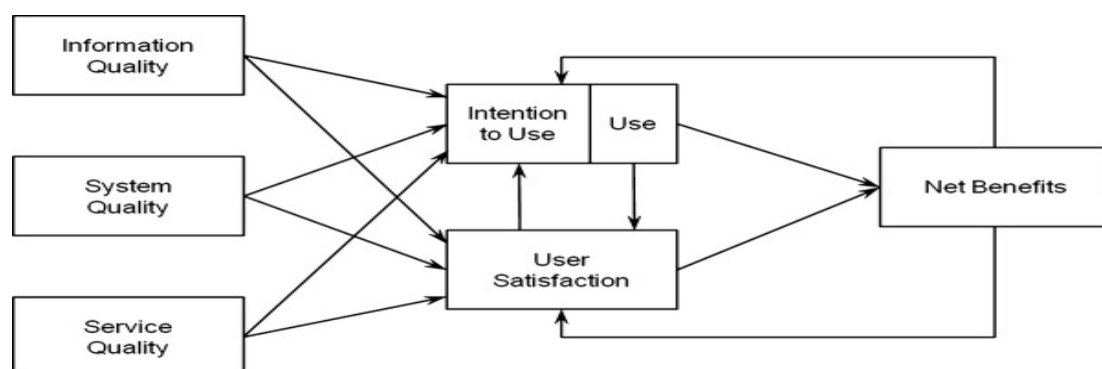

Figure 1. D&M IS Success Model

Previous e-learning studies shown strong attention to the D&M IS Success Model (e.g. Yakubu & Dasuki, 2018), reliability and validity of the D&M IS Success Model (2003) have been tested and achieved in many e-learning studies (e.g. Mohammadi, 2015; Yakubu & Dasuki, 2018). However, employing the D&M IS Success Model (2003) in MOOC is very rare (Aparicio et al., 2019), thus, this study provides an empirical test of the D&M IS Success Model in the MOOC context.

Research Model

This study adopted a part of the D&M IS Success Model (2003), as shown in Figure 2. The justification for selecting the D&M IS Success Model in this study is to meet the aims of this study, which is to examine the influence of the quality antecedents (i.e. SQ, IQ, SRQ) on satisfaction toward MOOC. Figure 2 displays the research model.
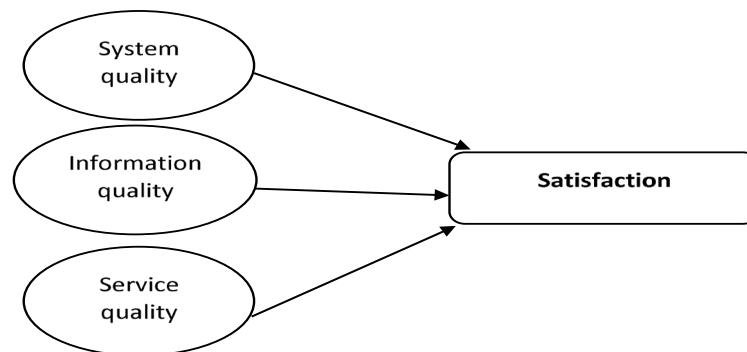

Figure 2. Research model

Satisfaction

In this study, satisfaction refers to the learner's level of gratification with MOOC usage and performance. Satisfaction can be measured by aspects such as the usefulness and the effectiveness of MOOCs. MOOC literature emphasized that learner satisfaction significantly influenced the use of MOOC (Gameel, 2017; Gutierrez-Santiuste, et al., 2015; Kevan et al., 2016) and suggested that satisfaction is a key factor in evaluating the quality of MOOC (e.g. Albelbisi, 2020; Aparicio et al., 2019). Hence, this study examines learner satisfaction as a dependent factor to understand MOOC quality issues.

Quality Antecedents

According to D&M IS Success Model, the independent factors (i.e. SQ, IQ, SRQ) are represented the quality antecedents.

System Quality (SQ)

In this study, system quality refers to the perceived overall quality of MOOCs. It is measured by (1) easiness to use the MOOC; (2) easiness to learn and operate the MOOC; and (3) contains the necessary features and functions. System quality factor is expected to have a positive influence on satisfaction toward MOOC (Albelbisi, 2019; Fianu et al., 2018; Gamage et al., 2015; Yang et al., 2017). Thus, the proposed model tests the research hypothesis *H1: There is a positive relationship between system quality and learners' satisfaction.*

Information Quality (IQ)

In this study, information quality refers to the ability of MOOC to provide the information that is easy to understand, up to date, meets learners' needs, relevant, and always available. Information quality is proposed to be a significant factor that demonstrates learner satisfaction toward MOOC (Drake et al., 2015; Gamage et al., 015; Yepes-Baldo et al., 2016). Thus, the proposed model tests the research hypothesis *H2: There is a positive relationship between information quality and learners' satisfaction.*

Service Quality (SRQ)

In this study, service quality can be described as the guidelines or the support documents delivered by MOOCs. Service quality can be measured by aspects such as the technical staff support (e.g. the staff knowledge, understanding, and response) and the IT resources (e.g. server availability). Service quality is expected to impact satisfaction positively (Albelbisi & Yusop, 2019; Nagashima, 2014; Yang et al., 2017). Thus, the proposed model tests the research hypothesis **H3:** *There is a positive relationship between service quality and learners' satisfaction.*

METHODOLOGY

Research Design and Instrument

This research is mainly quantitative, conducted using cross-sectional research. The quantitative approach is an efficient method that tries to test the theory and explore the factors that impact the study results (Creswell, 2012). Thus, this method has been chosen as its suitable for examining the relationships between the quality antecedents (SQ, IQ, SRQ) and satisfaction toward MOOC.

The questionnaires used in this study were established by combining several validated instruments from e-learning system success literature. System quality and information quality factors were measured with scales developed by (Alsabawy, Cater-Steel, & Soar, 2012). Service quality was measured by scale adapted from Ozkan, Koseler, and Baykal (2009) while the satisfaction factor was measured by a scale for Sun, Tasi, Finger, and Chen (2008).

The initial version of the instrument was reviewed by five faculty members to ensure that the questionnaire design, wording, and measurement scales were appropriate and to confirm that the instrument is suitable for this research that examining the effect of the quality antecedents on satisfaction toward MOOC.

Besides, pre-tested with ten graduate students was conducted. The participants were asked to take the survey online and provide comments about the content of questions and format to ensure the clarity and appropriateness of the items. This evaluation was conducted to check whether all instructions and questions were understood as we intended.

Some amendments were made to the phrasing to outfit the context of MOOC. For example, the original item for system quality "The e-learning system is easy for me to learn" has been modified to "For me, the MOOC system is easy to learn". The original item for information quality "The LMS provides sufficient information" has been changed to "I believe that MOOC provides sufficient information", and the original item for service quality "Instructor's attitudes are friendly to learners." has been revised to "In learning through MOOC, I think that instructor's attitudes are friendly to learners". The final version of the instrument included a 21-item survey scored based on a 5-point Likert scale (strongly agree (5) to strongly disagree (1)).

Participants

The population of this study was undergraduate students from five public universities in Malaysia: UKM, UiTM, UNIMAS, UPM, and UTeM universities. A total of 1000 students engaged in MOOC via OpenLearning platform, yet, six hundred and twenty-two surveys were returned for a response rate of 62.2%. The target population in the study consisted of students who have ever taken at least one MOOC course in the OpenLearning platform.

Data Collection

This study has employed an online survey method to collect data from the study sample. The initial request for accessing the online survey was sent to the participants through the Chat feature in the MOOC platform "OpenLearning". After two weeks, a reminder letter with the link of the questionnaire has been sent to the MOOC participants to encourage them to answer the survey.

Pilot Test

A small pilot test was conducted involving 52 students from University Malaya (UM) who have enrolled in UM's MOOC course titled "Malaysian Taxation" through "OpenLearning" the MOOC platform in Malaysia. The result indicated that Cronbach alpha value (α) was 0.81 > 0.7; hence, the result of the pilot study verified good reliability (George & Mallery, 2012).

FINDINGS

In this study, the PLS-SEM analysis method via the measurement and the structural model used to examine the proposed model. PLS-SEM method enables the researcher to study how well the predicting variables (independent/exogenous) explain the dependent variable (endogenous) (Hair, Hult, Ringle, & Sarstedt, 2014).

Reliability

The reliability had been verified via Cronbach's alpha (α). The finding revealed that α value (0.87 > 0.70) is showing sufficient reliability (George & Mallery, 2012).

Examination of the Measurement Model

In the first stage, the analysis of the measurement model was conducted by gauging the convergent and discriminant validity.

The convergent validity has been evaluated through (1) factor loading, each item should be > 0.50 (Henseler, Ringle, & Sarstedt, 2015). (2), the Average Variance Extracted (AVE) should be greater than 0.50. (3) Composite reliability (CR) that should be exceeded 0.7 (Hair et al., 2014). Table 1 shows the findings of convergent validity.

Table 1. The convergent validity analysis

Construct	Code	Loadings	CR	AVE
Information quality	IQ1	0.78	0.88	0.65
	IQ2	0.82		
	IQ3	0.81		
	IQ4	0.81		
Satisfaction	SAT1	0.80	0.93	0.62
	SAT2	0.82		
	SAT3	0.82		
	SAT4	0.81		
	SAT5	0.81		
	SAT6	0.74		
	SAT7	0.79		
	SAT8	0.72		
System quality	SQ1	0.80	0.89	0.63
	SQ2	0.81		
	SQ3	0.84		
	SQ4	0.81		
	SQ5	0.70		
Service quality	SRQ1	0.84	0.88	0.64
	SRQ2	0.84		
	SRQ3	0.81		
	SRQ4	0.70		

Table 1 shows that the factor loadings for all items were ≥ 0.7, the AVE values exceeded 0.5, and CR values were above 0.8, indicating sufficient convergent validity.

Next, the discriminant validity of the model factors was tested by the new Heterotrait-Monotrait (HTMT) criteria using PLS (Henseler et al., 2015). Discriminant validity is used to confirm that the measurement items of a particular factor are represented that factor (Hair et al., 2014). The HTMT analysis is shown in Table 2.

Table 2. The HTMT analysis

	IQ	SA	SRQ	SQ
IQ				
SA	0.745			
	CI.90 (0.68, 0.80)			
SRQ	0.746	0.618		
	CI.90 (0.68, 0.81)	CI.90 (0.54, 0.69)		
SQ	0.874	0.824	0.719	
	CI.90 (0.82, 0.92)	CI.90 (0.78, 0.87)	CI.90 (0.65, 0.78)	

Note: SA: satisfaction; SQ: system quality; IQ: information quality; SRQ: service quality

The findings of the HTMT analysis exposed that the HTMT 0.90 values were less than 0.90. This result, therefore, shows that all values passed the value of 0.90 tests and the discriminant validity has been achieved (Henseler et al., 2015).

Examination of the Structural Model

The structural model was evaluated according to the following measures:

Path Coefficients

Path coefficients used to examine the significance of the study hypotheses and to show the strength of a relationship between two variables (Illowsky, & Dean, 2013). Bootstrapping technique with 5,000 resamples via PLS was used to obtain beta (β) value and t-values. Table 3 displays the bootstrapping results.

Table 3. Bootstrapping results and hypotheses testing

Hypotheses	Relationship	Std Beta	Std Error	T-value	P-value	Supported
H1	SQ -> SAT	0.38	0.05	7.48**	000	**Yes**
H2	IQ -> SAT	0.07	0.05	1.38	0.17	No
H3	SRQ -> SAT	0.02	0.04	0.59	0.56	No

Note. (t-values > 1.645* where $p < 0.05$), (*t*-values > 2.33** where $p < 0.01$);

Referring to Table 3, SQ (β = 0.38, $p < 0.01$) was found to have a strong influence on satisfaction toward MOOC, thus H1 is supported. While IQ (β = 0.07) and SRQ (β = 0.02) were not significant to satisfaction toward MOOC ($p > 0.05$). This showed that SQ and IQ factors were not influencing satisfaction toward MOOC, hence, H2 and H3 were not supported.

Effect Sizes (f 2)

The effect size (f ^{2}) has small effect when f²= 0.02, medium effect when f²= 0.15, and large effect when f²= 0.35 (Illowsky, & Dean, 2013; Henseler et al., 2015). The results for f ^{2} are shown in Table 4.

Table 4. The results of the f 2 effect sizes

Hypotheses	Relationship	Effect Size (f^2)	Effect Size
H1	SQ -> SAT	0.152	Medium
H2	IQ -> SAT	0.005	No effect
H3	SRQ -> SAT	0.001	No effect

Table 4 shows that the effect size of H1 ($f^2 = 0.152$) had a medium relationship. This indicated that the system quality factor best predicts satisfaction toward MOOC. While H2: (Information quality -> Satisfaction), H3: (Service quality -> Satisfaction) had no effect sizes.

DISCUSSION

The Relationship between System Quality and Satisfaction toward MOOC

System quality in this study is defined as desirable performance characteristics of a MOOC, it is measured by aspects such as easy to use, flexibility, and functionality of MOOC (Albelbisi, 2019). The finding of this hypothesis indicated that perceived system quality positively influenced learner satisfaction toward MOOC thus, the hypothesis (H1) is supported. In other words, the features and functions of MOOC had met students' expectations and generated a high satisfaction toward using MOOC.

If learners find that they can access the MOOC contents easily, that the platform is well structured, and that they can easily navigate in MOOCs, then learner's satisfaction toward using MOOCs will be improved. This finding supported by Azevedo and Marques (2017); Fianu et al. (2018); Gamage et al. (2015); Yang et al. (2017), all of these studies emphasized that system quality is a crucial factor impacting the MOOC environment.

This result suggested that MOOC designers have to confirm that MOOC is of good quality to improve learners' satisfaction toward learning via MOOC. This can be achieved by ensuring the MOOC platform is fixable, easy to use, easy to navigate, and visually attractive (Albelbisi & Yusop, 2019).

The Relationship between Information Quality and Satisfaction toward MOOC

Analyses indicated that the hypothesis (H2) was not significant. This means that information quality aspects such as understandability, usability, and availability of the information had not affected satisfaction toward MOOC.

MOOC is a learning method that offers several multimedia tools and materials to massive learners (Liyanagunawardena et al., 2019). These resources and information should be clear, available, and relevant to the learning objectives, and should be presented in a detailed format to allow the learners to accept the MOOC information easily (Albelbisi et al., 2018). Thus, any complexity, ambiguity, or conflict in the MOOC information may require learners to spend more time and extra effort to understand and review the information, which might be causing the information overload (Rai & Chunrao, 2016).

The insignificant relation between MOOC information quality and satisfaction is unexpected and contrary to prior MOOC studies by Drake et al., (2015); Gamage et al. (2015); Yepes-Baldo et al. (2016). All of these MOOC studies indicated that information quality influencing the MOOC environment positively.

Thus, it is important for academic staff to offer students with clear, sufficient, updated, and relevant information to the learning purposes and avoid the complexity and mystery of the MOOC information in order to improve satisfaction toward MOOC (Albelbisi, 2020).

The Relationship between Service Quality and Satisfaction toward MOOC

The survey findings indicated that service quality factor was not considered as a key factor in assessing satisfaction toward MOOC. Thus, the hypothesis (H3) was not supported. In other words, students in this

study perceived that the quality of MOOC services such as the availability of academic staff support and IT resources did not affect their satisfaction toward MOOC.

The possible clarification for this result may be related to the participants were beginner users to MOOC environments. The demographic data revealed that the majority of the participants (41 %) were novice learners to use MOOC and their experience is limited to participation in one MOOC course only. The participants of this study may have a lack of confidence to use and manage this novel technology and may not yet have been trained enough to use the full facilities of the MOOC. Thus, it is suggested that the administrators and academic staff train students obtain the necessary skills to use services provided by MOOC effectively. Training provides the essential skills that enable learners to use MOOCs for better learning results (Albelbisi et al., 2018).

Regarding the instructor interaction, educational institutions need to make sure that instructors teaching MOOCs are support and guidance learners in the learning process and provide feedback immediately via a variety of methods (Albelbisi et al., 2018).

The finding of H3 is not consistent with previous MOOC research, such as Yang et al. (2017); Nagashima (2014) found that the instructor support and the IT resources are key factors that impact the MOOC environment. Thus, it is worth conducting longitudinal studies to gain more understanding of this relationship.

IMPLICATIONS

The findings of this study may help to formulate strategies and methods that could improve the implementation of MOOCs. System quality is an important predictor of satisfaction toward MOOC as revealed from this empirical testing, thus, IT developers should confirm that MOOC is easy to use, easy to learn, and reliable to help students in the learning process via MOOC. Administrators also should arrange training sessions that develop instructors' skills to design effective MOOC structure and content to increase learner participation in MOOC and improve learning outcomes. Administrators should also provide workshops for students to support them to acquire the necessary skills they need to use MOOC efficiently and improve the acceptance and adoption of MOOC by the students.

LIMITATION AND RECOMMENDATIONS FOR FUTURE RESEARCH

This study is mainly used quantitative method, conducted using an online survey for gathering data. Thus, recommendations for future research include the need for qualitative data. Interviewing of the learners would provide in-depth data that will give a better understanding of the study findings and it could give a greater insight into the effect of quality antecedents on learners' satisfaction in MOOC.

The study used a part of the D&M IS Success Model (2003) and omitted some constructs such as (intention to use and net benefit) which would have been adapted to understand the advantages of MOOCs to the learners. Future works should be considered the inclusion of these significant factors to expand the view about MOOC success. Future study is also hoped to measure the influence of other factors, especially the factors that influence instructors' satisfaction toward using MOOCs for better understanding the quality antecedents of satisfaction in MOOCs.

CONCLUSION

This study investigated the effect of quality antecedents on learners' satisfaction toward MOOC based on the D&M IS Success Model (2003). This study demonstrated the key role of satisfaction in the MOOC context by examining the relationships between quality antecedents (i.e., SQ, IQ, SRQ) and satisfaction.

The study exposed that system quality has a significant influence on satisfaction, indicating that the higher the system quality of MOOC regarding easy to use the MOOC; easiness to learn and operate MOOC; and flexibility of MOOC; the more likely the learners satisfied with using MOOC. However, the findings of this study noted that information quality and service quality factors were not supported satisfaction toward MOOC.

The results of this study may give empirical evidence that should be useful to formulate effective strategies and methods for improving the implementation of MOOCs. By understanding the quality antecedents of satisfaction toward MOOCs; proper procedures can be adopted to enhance the implementation of MOOCs in educational institutions.

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