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A Predictive "Quality of Use" Model in Blended Learning

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ABSTRACT

The aim of this study is to develop a predictive model based on "quality of use" concept in blended learning using flipped classroom. The model incorporated contemporary variables, namely student engagement and student interaction. Data were obtained using survey method. A total of 281 undergraduate students participated in the study. Data were analyzed using SmartPLS. The finding revealed that the "quality of use" model is enhanced by integrating student engagement and student interaction. This model is only applicable for the context on this study, hence, a replication is required in order to confirm the variables used in similar research context.

Keywords: Quality of Use, Student Engagement, Entrepreneurship Education
JEL Classifications: I21, O32, O35

1. INTRODUCTION

Blended learning is considered as a new research area. One of the main issues in blended learning measurement is the disagreement in terminology used in publications, which leads to the difficulties in developing suitable measurements for this area (Graham et al., 2013). Previous scholars suggested that more studies are needed to explore and confirm the quality dimensions for blended learning (Martínez-Argüelles et al., 2013; Teo, 2010). A substantive discussions about theory, developing new framework that accompanied by empirical research, are seen as appropriate approaches to increase the understanding in this area (Halverson et al., 2014). Hence, the aim of this study is to develop a predictive model based on "quality of use" concept in blended learning using flipped classroom. The model will incorporate two contemporary variables, which are student engagement and student interaction to the existing 'quality of use' variables namely satisfaction, efficiency and effectiveness.

2. METHODOLOGY

The respondents of this study were undergraduates' students from a public university in Malaysia. The inclusion criteria used in the sample selection were students who enrolled for the Fundamental of Entrepreneurship (ENT300) subject during the semester of June-October, 2015. ENT300 is a university subject where every student must enroll and passed in order to be awarded their academic certificate. This situation increases the enrollment of this subject among students. However teaching and learning facilities in the university are limited to cater for such increases. As for that, the university encourages teaching and learning activities for ENT300 to be delivered through blended learning using flipped classroom since semester that commences in June 2012. The measurements for this study were adapted from various scholars. Satisfaction and student interaction measurements were adapted from Kuo et al. (2014), effectiveness and efficiency were adapted from Finstad (2010), and students engagement from Dixson (2010) supported by (Bevan, 1995; Bormann, 2014; McLaughlin et al., 2014). All continuous items are measured using 6 point Likert scale ranging from "1" refers to 'strongly disagree to "6" refers to "strongly agree." In order to improve the content validity, a professor, one senior lecturer and three students were asked to review the questionnaires. Amendments had been made before the final copies of the questionnaires were distributed.

Data were obtained using a survey method. Sample frame was derived from a student information management system provided

by an academic affair department. Samples were selected using a systematic sampling based on a stratified technique followed by random sampling using the nth sequence. A total of 324 students participated in the study, however only 281 questionnaires were qualified for further analysis. Data were analyzed using partial least squares structural equation modeling (PLS-SEM) method of analysis through SmartPLS. From 281 respondents who participated in this study, majority of the respondents were female 71.2% while male represented 28.8%. Majority of the students were 20-year-old (73.7%) and the highest respondents were from diploma in planting industry management with 51 students (18.1%). From the information obtained from the system, all respondents are Malay with Bumiputra status. Details of the respondents' profile are presented in the Table 1.

3. RESULT AND DISCUSSION

3.1. Data Screening and Preliminary Analysis

Prior to analyze the data, the authors run a preliminary analysis to eliminate the possible problems related with data such as biases or violating a statistical assumptions that may lead to the insignificance result. A total of 324 questionnaires were collected and coded into SPSS. There were no missing values reported for this set of data. The outlier's analysis eliminated a total of 43 cases (24 cases for univariate outliers and 19 cases of multivariate outliers, leaving only 281 cases that qualified for further analysis. All variables are normally distributed. The value of variance inflation factors of each predictor is below 10 indicating that items are free of multicollinearity issue. Since data for this study were analyzed using PLS-SEM.

Table 1: Profile of respondents

Demographic factors	Frequency n (%)
Gender	
Male	81 (28.8)
Female	200 (71.2)
Total	281 (100)
Age (years old)	
20	207 (73.7)
21	62 (22.1)
22	9 (3.2)
23	2 (0.7)
25	1 (0.4)
Total	281 (100)
Program	
AC110 Diploma in Accountancy	22 (7.80)
AC120 Diploma in Accounting Information Systems	12 (4.3)
AP120 Diploma in Geomatics Science	19 (6.8)
AP122 Diploma in Geomatics Science (Natural Resources)	13 (4.6)
AS115 Diploma in Industrial Chemistry	7 (2.1)
AT110 Diploma in Planting Industry Management	51 (18.1)
BM111 Diploma in Business Studies	24 (8.5)
BM119 Diploma in Banking	42 (14.9)
CS110 Diploma in Computer Science	27 (9.6)
CS143 Diploma In Mathematical Sciences	18 (6.4)
SR113 Diploma in Sports Studies	47 (16.7)
Total	281 (100)

3.2. Measurement Model

All measures in the model are reflective constructs. The estimates in the path-modeling indicate that the algorithms for this model converged after iteration 5, thus confirming that the estimation is normal (Hair et al., 2014). Summary for measurement model is exhibited in Table 2. Results from this study reveal that the value for composite reliability (CR) are 0.912 (efficiency), 0.921 (effectiveness), 0.888 (satisfaction), 0.941 (student interaction) and 0.898 (student engagement). This demonstrated that all variables have high level of internal consistency reliability (Hair et al., 2014). Please refer to Table 2.

Validity assessment for reflective measurement model was evaluated using convergent and discriminant validity. Convergent validity looks at the extent in which an item correlates with another item in the same construct. In order to test convergent validity, the authors consider the indicator of outer loadings for all items, and the average variance extracted (AVE). There are five latent variables involved in this study; efficiency, effectiveness, satisfaction, student interactions and student engagement represented by 37 continuous items. The outer loading presented in Table 2 shows the item loading for engagement 1 and Engagement are below 0.708. However these items were retained because the average loading for student engagement items is 0.723 (Hair et al., 2014). As for AVE, result for this study exhibits that the value for AVE of the measured variables 0.722 (efficiency), 0.745 (effectiveness), 0.615 (satisfaction), 0.500 (student interaction) and 0.525 (student engagement) respectively. All AVE are reported above 0.500, therefore the convergent validity for constructs is adequate (Hair et al., 2014).

Discriminant validity for this model is measured using cross loadings table and Fornell-Larcker criterion (Hair et al., 2014). Cross loading value in Table 3 indicates that loadings for items that represent a construct are higher as compared to all cross loadings for other constructs, thus indicates discriminant validity. Further analysis was conducted using Fornell-Larcker criterion (Table 4). The squared AVE values represented by value on the diagonal of the table and the interconstruct correlations value represented by off the diagonal. It can be seen that all AVE values are higher than interconstruct presented by correlation values, except for correlation for Student Interaction and Student Engagement with the value 0.750 and the squared AVE is 0.707. Since student Interaction is represented by hierarchical component model, and items is represented by cross loadings for student interactions and the values are higher than the values of cross loadings for student engagement, it is concluded that this model has achieved a discriminant validity (Hair et al., 2014).

The aim of this study is to develop a predictive model based on "quality of use" concept in blended learning using flipped classroom approach by incorporating contemporary issues, which are student engagement and student interaction. From the measurement model analysis using SmartPLS, the result indicates that, the enhancement of "quality of use" model is reported as valid and reliable. The enhancement of contemporary variables namely student engagement and student interaction to the existing "quality of use" concept are applicable in explaining blended learning

Table 2: Results summary for measurement model

Latent variable	Indicator	Loading	CR	AVE	Discriminant validity
Efficiency	Efficiency 1	0.794	0.912	0.722	Yes
	Efficiency 2	0.868			
	Efficiency 3	0.876			
	Efficiency 4	0.859			
Effectiveness	Effectiveness 1	0.807	0.921	0.745	Yes
	Effectiveness 2	0.872			
	Effectiveness 3	0.882			
	Effectiveness 4	0.888			
Satisfaction	Satisfaction 1	0.772	0.888	0.615	Yes
	Satisfaction 2	0.852			
	Satisfaction 3	0.817			
	Satisfaction 4	0.724			
	Satisfaction 5	0.751			
Student interaction	Interact SS1	0.779	0.941	0.500	Yes
	Interact SS2	0.789			
	Interact SS3	0.773			
	Interact SS4	0.753			
	Interact SS5	0.768			
	Interact SS6	0.708			
	Interact SS7	0.726			
	Interact SI1	0.767			
	Interact SI2	0.804			
	Interact SI3	0.836			
	Interact SI4	0.861			
	Interact SI5	0.768			
	Interact SC1	0.871			
	Interact SC2	0.908			
	Interact SC3	0.889			
	Interact SC4	0.831			
Student engagement	Engagement 1	0.672	0.898	0.525	Yes
	Engagement 2	0.749			
	Engagement 3	0.747			
	Engagement 4	0.709			
	Engagement 5	0.754			
	Engagement 6	0.664			
	Engagement 7	0.764			
	Engagement 8	0.728			

AVE: Average variance extracted, CR: Composite reliability

Table 3: Cross loading for measurement model

Latent variable	Indicator	Efficiency	Effectiveness	Student interaction	Satisfaction	Student engagement
Efficiency	Efficiency1	0.794	0.572	0.496	0.439	0.376
	Efficiency2	0.868	0.623	0.483	0.394	0.379
	Efficiency3	0.876	0.664	0.526	0.462	0.402
	Efficiency4	0.859	0.697	0.502	0.500	0.401
Effectiveness	Effectiveness1	0.647	0.807	0.500	0.522	0.426
	Effectiveness2	0.625	0.872	0.612	0.487	0.480
	Effectiveness3	0.670	0.882	0.589	0.540	0.516
	Effectiveness4	0.662	0.888	0.584	0.490	0.434
Satisfaction	Satisfaction1	0.454	0.431	0.473	0.772	0.467
	Satisfaction2	0.429	0.504	0.521	0.852	0.480
	Satisfaction3	0.426	0.491	0.521	0.817	0.484
	Satisfaction4	0.366	0.383	0.452	0.724	0.375
	Satisfaction5	0.396	0.494	0.462	0.751	0.433
Student interaction	InteractSS1	0.453	0.561	0.730	0.529	0.531
	InteractSS2	0.454	0.536	0.730	0.518	0.533
	InteractSS3	0.334	0.412	0.678	0.408	0.490
	InteractSS4	0.366	0.436	0.672	0.410	0.494
	InteractSS5	0.377	0.460	0.696	0.463	0.504
	InteractSS6	0.403	0.459	0.677	0.385	0.459
	InteractSS7	0.427	0.484	0.666	0.399	0.516
	InteractSI1	0.446	0.514	0.707	0.468	0.544

Contd...

Table 3: Continue...

Latent variable	Indicator	Efficiency	Effectiveness	Student interaction	Satisfaction	Student engagement
	InteractSI2	0.377	0.466	0.711	0.433	0.548
	InteractSI3	0.401	0.464	0.698	0.380	0.519
	InteractSI4	0.393	0.427	0.736	0.395	0.539
	InteractSI5	0.431	0.453	0.690	0.352	0.501
	InteractSC1	0.474	0.458	0.717	0.452	0.547
	InteractSC2	0.466	0.479	0.733	0.502	0.548
	InteractSC3	0.474	0.473	0.750	0.497	0.594
	InteractSC4	0.393	0.422	0.717	0.404	0.601
Student engagement	Engagement1	0.304	0.344	0.493	0.436	0.672
	Engagement2	0.360	0.400	0.621	0.491	0.749
	Engagement3	0.296	0.341	0.517	0.394	0.747
	Engagement4	0.323	0.370	0.501	0.412	0.709
	Engagement5	0.372	0.478	0.633	0.455	0.754
	Engagement6	0.315	0.406	0.494	0.307	0.664
	Engagement7	0.356	0.392	0.539	0.402	0.764
	Engagement8	0.321	0.375	0.517	0.402	0.728

Table 4: Discriminant validity (Fornell-Larcker criterion)

Latent variable	1	2	3	4	5
Efficiency	0.850				
Effectiveness	0.753	0.863			
Student interaction	0.591	0.664	0.707		
Satisfaction	0.529	0.589	0.621	0.784	
Student engagement	0.459	0.539	0.750	0.573	0.724

using flipped classroom. This conclusion can be drawn by the result of CR, AVE and discriminant validity using Fornell-Lacker criterions. The result clearly indicates that student interaction has relationship with satisfaction, efficiency and effectiveness. This empirical finding supports previous literatures from similar context that has positive impacts between student interactions and "quality of use" variables (Papastergiou, 2009; Piccoli et al., 2001; Zhang et al., 2006). This study also reveals that student engagement has influence on satisfaction, effectiveness and student interaction. This empirical finding supports previous scholars who reported similar result (Hair et al., 2011; Wong, 2013) in the same research context.

4. CONCLUSION

This study provides an empirical finding to support the development of a comprehensive "quality of use" predictive model. This model was developed based on the original concept introduced by Bevan (1995), where the main variables identified were satisfaction, effectiveness and efficiency. The enhancement of this predictive model incorporated two contemporary variables namely student engagement and student interaction. This predictive "quality of use" model is able to explain blended learning using flipped classroom. Therefore, this model is suitable to be used by blended learning administrator in order to gauge the perception of users based on the tested constructs, especially in the flipped classroom setting. However, this finding only represents the context of this study. Hence, more studies need to be replicated to confirm the model, specifically the relationship between student engagement and student interaction in various context in blended learning.

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