10-2021

Investigating Factors Affecting Students' Satisfaction with Computer-based Assessment

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Abstract

The present study revealed that 1) perceived technical difficulties and 2) self-confidence in using a computer, were significant predictors of students' satisfaction with computer-based assessment (CBA). Students were more likely to be satisfied with CBA when they perceived fewer technical difficulties and felt more confident in using a computer.

Introduction

Theoretical framework

Despite the increasing use of computer-based assessment (CBA), there remains a dearth of evidence of what factors contribute to students' satisfaction with CBA. We investigated four factors that are extracted from the TIMSS 2019 (Trends in International Mathematics and Science Study) Student Questionnaire eTIMSS Supplement – which was designed to examine student's experience with the computer version of TIMSS (Mullis, Martin, Foy, Kelly, & Fishbein (2020). The four factors were perceived technical difficulties, frequency of computer or tablet usage at school, self-confidence in computer or table usage, and familiarity with information and communication technology (ICT) terminology.

Research Question

The purpose of this study was twofold: to examine the hypothetical factor structure of the TIMSS 2019 Student Questionnaire (eTIMSS Supplement), and to investigate which factors make a unique contribution in predicting students' satisfaction with CBA.

- Research Question 1: Does the TIMSS 2019 Student Questionnaire (eTIMSS Supplement) consist of four factors of perceived technical difficulties, frequency of computer or tablet usage at school, self-confidence in using computer or tablet, and familiarity with ICT terminology?
- Research Question 2: Which factors contribute to predicting students' membership toward satisfaction with CBA (satisfied with CBA vs. dissatisfied with CBA)?

Methodology

The U.S. sample drawn from the TIMSS 2019 consists of 8,698 students. The 26 items that have been used in this study; 10 items asking perceived technical difficulties were on 2-point scales of 1 (*Yes*) and 2 (*No*), while the others were on 4-point Likert scales that ranged from 1 (*agree a lot*) to 4 (*disagree a lot*). In this study, satisfaction with CBA was used as a dependent variable and the other four variables were used as independent variables. This study followed two steps of analysis. First, confirmatory factor analysis (CFA) was performed to substantiate the hypothesized four-factor latent structure. We used the diagonal weighted least squares (DWLS) estimator, which is recommended to be a good estimator for Likert scales (Xia & Yang, 2019). Next, we conducted binary logistic regression to investigate the contribution of the individual

factors in predicting students' satisfaction with CBA. As we have a categorical dependent variable and Likert-scale predictor variables, logistic regression was chosen to analyze the data. The dependent variable, satisfaction with CBA, was reclassified into two categories of 1 (*satisfied*) versus 0 (*dissatisfied*) for more intuitive interpretation. All analyses were conducted using the statistical program R.

Results

Descriptive Statistics

As shown in Table 1, a composite score (mean) was used to group items into predictors. The items were reversely coded so higher scores indicate more positive attitudes toward computer-based assessments, more technical difficulty, more frequent usage of a computer or tablet, more self-confidence in using computers, and more familiarity with ICT terminologies. 6,582 students (88.46%) were satisfied with CBA, while only 859 students (11.54%) were dissatisfied with CBA.

Confirmatory Factor Analysis

CFA was performed to substantiate the hypothesized four-factor structure. After deleting one problematic item (item 23), all fit indices were within the preferred range (Hu & Bentler, 1999). The chi-square was statistically significant , χ^2 (246, N = 7441) = 1512.643, $p < 0.001$. The other fit indices showed that the model fit the data very well (CFI = 0.955, TLI = 0.950, RMSEA = 0.026, and SRMR = 0.038). We have reasonable main factor loadings ranged from 0.334 to 0.461 (M = 0.381) for perceived technical difficulty, from 0.530 to 0.690 (M = 0.601) for frequency of computer or tablet usage at school, from 0.517 to 0.634 (M = 0.576) for self-confidence, and from 0.376 to .672 (M = 0.570) for familiarity with ICT terminology. We concluded that the four-factor structure CFA model provided an appropriate representation of the latent structure.

Logistic Regression

Logistic regression was performed to examine the contribution of predictors in students' satisfaction with CBA membership. Table 2 presents coefficients, standard errors, and odds ratios for the variables used in the analysis. The model correctly classified 89.07% of students ($\chi2$ (4) = 132.08, $p < .001$) and the Nagelkerek R2 was 0.114. Two predictors were statistically significant: perceived technical difficulties ($\beta = -3.22$, $p < .001$), and familiarity with ICT terminology ($\beta = 0.95$, $p < .001$). The results show that satisfaction with CBA was 0.04 times less likely for every one-unit increase in the perceived technical difficulties. In contrast, satisfaction with CBA was 2.58 times more likely for every one-unit increase in self-confidence in using a computer or tablet.

$$Logit\ (Satisfied\ vs.\ Dissatisfied\ with\ CBA) = \beta_0 + \beta_1\ (Perceived\ Technical\ Difficulties) + \beta_2\ (Frequency\ of\ Computer\ or\ Tablet\ Usage) + \beta_3 (Self\text{-}confidence) + \beta_4\ (Familiarity\ with\ ICT\ Terminology)$$

Discussion

The main aim of this study was to investigate the factors that make a unique contribution to predicting students' satisfaction with CBA. The results confirmed that students with less perceived technical difficulties and more confidence seemed to be more satisfied with CBA. This implies that we need to minimize technical issues when setting up a CBA platform as well as encourage students to have more confidence in computer or tablet usage to maximize the benefit of CBA. These findings are consistent with previous studies saying that technical difficulties could hamper the benefit of online learning (Sitzmann, Ely, Bell & Bauer, 2010), and self-efficacy positively influences students' online learning experience (Artino, 2010).

Two important limitations should be noted when interpreting the results of this study. First, this study was based on the imbalanced data where the distribution was skewed toward a satisfaction group; most students responded that they were satisfied with CBA while only a small portion of students was not satisfied with CBA. Further investigation may be needed to tackle the issue of imbalanced data. Second, further studies should be encouraged to analyze samples from other cultures or educational systems, such as Asia or Europe, to generalize the results. Notwithstanding these limitations, this study contributes to the existing literature by revealing significant factors for predicting students' satisfaction with CBA and thereby maximizing students' positive experience with CBA.

Appendix

Table 1

Item Means and Standard Deviations of Variables used in Analysis

Items		*Mean*	*SD*
Satisfaction with Computer-based Assessments (CBA)		1.88	0.32
1	Did you like that this test was on computer or table?	1.88	0.32
Perceived Technical Difficulties		1.11	0.16
2	I had trouble using the number pad	3.27	0.89
3	I had trouble using the number pad	2.66	1.17
4	Objects were hard to drag	2.81	1.06
5	There was no good place to work out my answers	2.60	0.93
6	The computer or tablet was slow	3.54	0.61
7	I had to start my test over because of a computer or tablet problem	3.30	0.76
Frequency of Computer or Tablet Usage at School		2.83	0.73
8	At school this year, how often did you use a computer or tablet to do each of the following? Work on a school assignment such as a paper, report, or presentation	3.85	0.44
9	At school this year, how often did you use a computer or tablet to do each of the following? Mathematics schoolwork	3.67	0.60

10	At school this year, how often did you use a computer or tablet to do each of the following? Science schoolwork	3.87	0.42
11	At school this year, how often did you use a computer or tablet to do each of the following? Take a test or quiz	3.81	0.50
Self-confidence in Using Computer or Tablets		3.68	0.38
12	I am good at using a computer	3.71	0.61
13	I am good at typing	3.82	0.46
14	I can use a touchscreen on a computer, tablet, or smartphone	2.73	1.11
15	It is easy for me to find information on the Internet	3.62	0.72
16	I can look up the meanings of words on the Internet	3.82	0.51
17	I can write sentences and paragraphs using a computer	3.00	1.02
18	I can edit text on a computer	3.44	0.85
Familiarity with ICT Terminology		3.51	0.46
19	How well do you know the meaning of each of the following terms? WiFi	3.73	0.63
20	How well do you know the meaning of each of the following terms? Firewall	3.90	0.39
21	How well do you know the meaning of each of the following terms? Instant messaging	1.12	0.32
22	How well do you know the meaning of each of the following terms? Cut and paste	1.17	0.37
23	How well do you know the meaning of each of the following terms? Spreadsheet	1.05	0.21
24	How well do you know the meaning of each of the following terms? Icon	1.16	0.36
25	How well do you know the meaning of each of the following terms? Drag and drop	1.13	0.34
26	How well do you know the meaning of each of the following terms? Scroll	1.03	0.16

Table 2

Logistic Regression for Students' Satisfaction with CBA

Variables	*β*	*SE*	*OR*
Perceived Technical Difficulties ***	-3.22	0.34	0.04
Frequency of Computer or Tablet Usage at School	-0.08	0.10	0.92
Self-confidence in Using Computer or Tablet ***	0.95	0.18	2.58
Familiarity with ICT Terminology (FT)	0.07	0.15	1.07

Note. β = unstandardized regression coefficient; OR = odds ratio; *** $p < .001$

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