



Analysis of Students' Perception on Digital E-Textbook Usage in Department of Mathematical Sciences, UTM

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Abstract

As the usage of digital technology becoming more popular in society, e-textbook have started to be use widely by student and educators especially in higher education institution. However, the expanded use of e-textbooks was not easily achieved because of the missing standards in learning content and functionalities, and barriers in utilizing e-textbooks. This study aims to analyse the students' perception about the use of e-textbook as an option to printed textbook and finds out the factor the factor that can motivates them to adopt e-textbook in their learning. Data was collected via an online survey conducted in the Department of Mathematical Sciences, Universiti Teknologi Malaysia with the participation 82 undergraduate mathematics programme students. Results of the study indicates that perceive ease of use of e-textbook features is identified as the factor that contribute of a student in choosing electronic medium for their academic reading text. This study suggest that students are more likely choose e-textbook as their preferred reading medium if they perceive that using e-textbook are easy.

Keywords: E-textbook; perception; textbook; logistic regression

1. Introduction

E-textbook is a digital version of a traditional printed textbook that is accessible through electronic devices such as e-readers, smartphones, tablets and computers. E-textbooks often have the same content as their printed versions but are accessible online in a digital version that are easy to be downloaded. The usage of e-textbook can encourage reading activities among students. Reading has always been seen as a vital activity for human. This is because reading helps the brain to learn, grow and expand its knowledge. Besides that, reading is also essential to the learning process. Sharma [1] mentioned that one method of learning new things is through reading. Reading is a method of communicating ideas from the author to the reader through a written text, which may be printed or electronically transmitted.

With the advancement of technology, there are various kind of books that have been developed over the years. In education sector, textbooks play an important element that helps to facilitate student with the process of learning instead of various source of knowledge. For example, in order to pass a course at the university, students are frequently obliged to purchase a textbook, which may be printed or digital. Internet has caused a major transformation in the industry thus enhance the development of digital books. With e-textbooks, students can view their study material on electronic device and they can download files to store on their computer or device for future reference. Higher education institutions, especially at universities all over the world are adopting e-textbooks more frequently because they view them as the best type of text resource for studying and teaching [2]. Additionally, the COVID-19 pandemic that has swept throughout the world has expedited the shift from traditional to digital platforms in higher education institutions [3].

2. E-textbook in education

According to Hamed and Ezaleila [4], digital textbooks are electronic books used as texts in the classroom. Digital textbooks are also known as electronic text books or electronic text (e-textbook or e-text). This textbook is the main component in technology-based education reform that is now increasingly dominating the world of education in developed countries. This electronic book acts as a text to be used in teaching face-to-face in classrooms, and as a tool for online teaching. E-textbooks gained popularity in the previous years. For instance, e-textbook has been used in educational systems of over 20 nations include Singapore, the United Kingdom, the United States, South Korea, Japan, France, and Malaysia [5]. Traditionally, education systems rely on printed materials. Because publishing process takes time and money, printed textbooks are targeted for use in a certain time period, for example five to ten years. However, changes and latest development often makes the content in textbooks become stale and irrelevant once the book is published. As such, printed textbooks is not an effective tool to be used in educational system, especially in the context of rapid changing in science and technology [4]. E-textbooks have potential advantages over traditional print textbooks in the areas of cost, student engagement, reading comprehension and mobile learning. E-textbooks offer many features that can lead to increased interaction between students and the learning content and between students and instructors [6].

3. Students' Perception and Acceptance towards E-textbook

A lot of research had been conducted in order to investigate the perception of e-textbook in any area of concern. In a study by Osih and Singh [7] on 80 third year students of Information Technology department of the university based in Midrand, South Africa to investigate the students' preference medium of reading academic text, they explored that most of students prefer to use e-textbook compared to the printed textbook. Based on the study conducted, they also discovered that some of the factors that influence preference include low cost, portability, convenience, easy access, ease of annotation, and textual features.

Wiese and Du Plessis [8] discussed the students' perceptions and use of e-textbooks. The participants of this study were among 620 second year students that registered for the module Integrated Brand Communication (BEM 224) at the University of Pretoria, South Africa. In analysing the survey conducted, two categories were created: non-users, or those respondents who said they never or very never used their e-textbooks, and users, or those respondents who said they frequently used e-textbooks. Their study revealed that e-textbooks are viewed negatively by non-users more than by users. However, the overall attitude of students towards e-textbooks was quite positive. Thus, it is reasonable to assume that students will be more optimistic once they begin using e-textbooks.

Another study conducted by Ngafeeson and Sun [9], they investigated how students' acceptance of e-textbooks is influenced by technology innovativeness (peoples' receptivity to new technologies). The results imply that students' willingness to experiment with new technology has an indirect influence on their intention to use e-textbooks as well as a direct beneficial impact. Additionally, the study also demonstrates how a given technology's acceptability, adoption, and use behaviours can be moderated by the quantity of exposure to a specific technology. From this study, the researchers suggested that educators support their students' own innovation before implementing new systems. This might be accomplished by providing new instructional and training course modules that concentrate on inspiring students to use educational technologies tactically and strategically, with an emphasis on the benefits these students stand to earn from using these new technologies.

In a research conducted by Letchumanan and Tarmizi [10] in Universiti Putra Malaysia (UPM), they found that majority of respondents use e-textbooks to conduct research for their assignments and find reading materials. However, very few of the respondents use an e-textbook as their textbook or the suggested text for their course. A significant number of respondents said that they preferred using

physical textbooks over e-textbooks, despite the survey's findings that the majority of respondents said they like reading e-textbooks on screens.

4. Methodology

4.1 Data Collection

The respondents that have been chosen for this study are among the third year and fourth year undergraduate of mathematics program from Faculty of Science. By collecting their responses based on the questionnaire about their perception on the use of e-textbook as an option to the printed textbook, we can identify the reading preference for undergraduate student of Department of Mathematical Sciences, Faculty of Science, UTM.

4.2 Binary Logistic Regression

Logistic regression is a statistical procedure used to investigate research questions that focus on the prediction of a discrete, categorical outcome variable from one or more explanatory variables. In this study, we are going to test model in the figure below that have been used in research by Terpend *et al.* [11], via logistic regression.

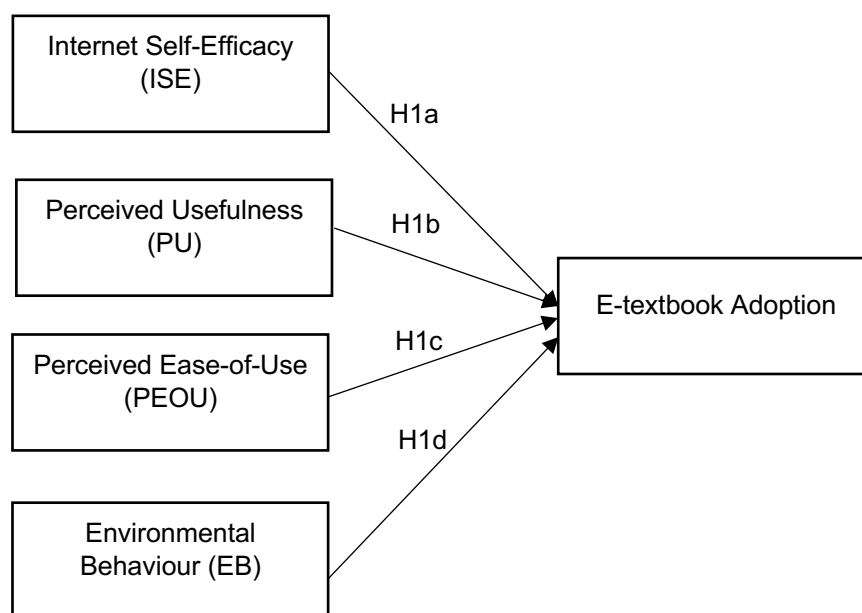


Figure 1 Antecedents of e-textbook adoption

Self-efficacy deals with one's impression or evaluation of being capable accomplish a task to achieve particular objectives. Self-efficacy beliefs have an impact on how people feel, think, behave, and motivate themselves [12]. It is proposed that the greater a person's self-efficacy with regard to the internet, the more likely it is that they will adopt an e-textbook because self-efficacy is positively associated with people's decisions to engage in activities, the effort that they expend, and their ultimate success. Perceived usefulness is "the degree to which a person believes that using a particular system would enhance his or her job performance" [13]. It is predicted that perceived usefulness has impact on e-textbook adoption.

Perceived ease-of-use is “the degree to which a person believes that using a particular system would be free of effort” [13]. The ease or difficulty of reading on a device screen compared to a page of paper is another factor that may have an effect on students’ perception. For instance, if the screen size of the reading device is too small may make reading process difficult for some student. The perceived difficulty in using e-textbook may differ depends on people, but it is suggested that perceived ease-of-use influence the adoption of e-textbook. Next, e-textbook have been suggested as a way for people to maybe lessen their environmental impact. Terpend *et al.* [11] expect students who are concerned about the natural environment to be relatively likely to adopt e-textbook. Therefore, Figure 1 summarizes all of the research hypotheses which are:

H_{1a} : A student’s likelihood of adopting an e-textbook is positively associated with his or her internet self-efficacy.

H_{1b} : A student’s likelihood of adopting an e-textbook is positively associated with the degree to which he or she perceives that e-textbook are useful.

H_{1c} : A student’s likelihood of adopting an e-textbook is positively associated with the degree to which he or she perceives that e-textbook are easy to use.

H_{1d} : A student’s likelihood of adopting an e-text is positively associated with his or her level of environmental concern.

4.3 Generalized Linear Models

In general, a generalized linear model consists of three parts which is:

- A distribution of the response conditioned on the predictors
- A linear combination of the $p - 1$ predictors, which we write as $\eta(x)$. That is,

$$\eta(x) = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_{p-1}x_{p-1}$$

- A link function, $g()$, that defines how $\eta(x)$, the linear combination of the predictors, is related to the mean of the response conditioned on the predictors, $E[Y|X = x]$.

$$\eta(x) = g(E[Y|X = x])$$

4.4 Binary Response

To illustrate the use of a generalized logistic model, we will focus on the case of binary responses variable coded using 0 and 1. The dependent variable in the modelling was students’ preference toward e-textbook compared to traditional printed textbook. The dependent variables were measured by using a binary scale random variable, with ‘0’ indicating student who preferred e-textbook as a medium for their academic reading text and ‘1’ indicating students who preferred printed textbook rather than e-textbook. The representation is written as below.

$$\text{Preference to read e-textbook} = \begin{cases} 0 & \text{if student answer yes} \\ 1 & \text{if student answer no} \end{cases}$$

Firstly, we define some notation that we will use throughout.

$$p(x) = P[Y = 1|X = x]$$

With a binary (Bernoulli) response, we will mostly focus on the case when $Y = 1$, since with only two possibilities, it is trivial to obtain probabilities when $Y = 0$.

$$P[Y = 0|X = x] + P[Y = 1|X = x] = 1$$

$$P[Y = 0|X = x] = 1 - p(x)$$

Now, we define the logistic regression model.

$$\log\left(\frac{p(x)}{1-p(x)}\right) = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_{p-1}x_{p-1}$$

The left-hand side is called the log odds, which is the log of the odds. The odds are the probability for a positive event ($Y = 1$) divided by the probability of a negative event ($Y = 0$). So when the odds are 1, the two events have equal probability. Odds greater than 1 favor a positive event. The opposite is true when the odds are less than 1.

$$\frac{p(x)}{1-p(x)} = \frac{P[Y = 1|X = x]}{P[Y = 0|X = x]}$$

Essentially, the log odds are the logit transform applied to $p(x)$.

$$\text{logit}(\xi) = \log\left(\frac{\xi}{1-\xi}\right)$$

$$\text{logit}^{-1}(\xi) = \frac{e^\xi}{1+e^\xi}$$

Note that : for $x \in (-\infty, \infty)$, this function outputs value between 0 and 1.

Model with error term is:

$$Y = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_qx_q + \epsilon, \quad \epsilon \sim N(0, \sigma^2)$$

This model can also be written as

$$Y|X = x \sim N(\beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_qx_q, \sigma^2)$$

While our main focus is on estimating the mean, $\beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_qx_q$, there is also another parameter, σ^2 which needs to be estimated. This is the result of the normal distribution having two parameters.

With logistic regression, which uses the Bernoulli distribution, we only need to estimate the Bernoulli distribution's single parameter $p(x)$, which happen to be its mean.

$$\log\left(\frac{p(x)}{1-p(x)}\right) = \beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_qx_q$$

By applying the inverse logit transformation allow us to obtain an expression for $p(x)$.

$$p(x) = P[Y = 1|X = x] = \frac{e^{\beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_{p-1}x_{p-1}}}{1 + e^{\beta_0 + \beta_1x_1 + \beta_2x_2 + \dots + \beta_{p-1}x_{p-1}}}$$

5. Results and discussion

Binary logistic regression was used to predicting the likelihood of a student in choosing electronic medium for their academic reading text based on independent variables that include Internet Self-efficacy (ISE), Perceived Usefulness (PU), Perceived Ease of Use (PEOU) and Environmental Behaviour (EB). By running a binary logistic regression analysis, the factors that are most strongly associated with a student's choice of medium can be determined. A preliminary analysis suggested that the assumption of multicollinearity was met at tolerance 0.846.

Table 1 Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	30.260	4	<.001
	Block	30.260	4	<.001
	Model	30.260	4	<.001

The model is not statistically significant, $\chi^2 (4, N = 82) = 30.260, p = < .001$, suggesting that it could not distinguish between those who prefer to read e-textbook or not.

Table 2 Block 0 Classification Table

		Observed		Predicted		Percentage Correct
				Preference		
		Printed	Electronic	Printed	Electronic	
Step 0	Preference	Printed	53	0	100.0	
		Electronic	29	0	.0	
	Overall Percentage				64.6	

- a. Constant is included in the model.
- b. The cut value is .500

The constant only model is good in predicting preference for printed medium 100% correct but the model is doing a poor job in predicting preference for electronic medium 0% correct, resulting in an overall classification accuracy of 64.6%. The sensitivity of the model is 0%. The specificity is 100%.

Table 3 Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	7.391	7	.389

The Hosmer-Lemeshow statistics in Table 3 shows that the significance value, p is 0.389 which is more than 0.05. Hence, the model fit the data.

Table 4 Contingency Table for Hosmer and Lemeshow Test

		Preference = Printed		Preference = Electronic		Total
		Observed	Expected	Observed	Expected	
Step 1	1	8	7.632	0	.368	8
	2	7	7.187	1	.813	8
	3	12	14.356	5	2.644	17
	4	7	6.542	1	1.458	8
	5	6	5.856	2	2.144	8
	6	8	5.290	1	3.710	9
	7	3	3.536	5	4.464	8
	8	2	1.911	7	7.089	9
	9	0	.690	7	6.310	7

The model adequately fits the data. As we can see, there is no difference between the observed and predicted model in Table 4. Both of the value is approximately equal.

Table 5 Block 1 Classification Table

	Observed	Predicted	
		Preference	Percentage Correct

		Printed	Electronic		
Step 1	Preference	Printed	48	5	90.6
		Electronic	11	18	62.1
	Overall Percentage				80.5

a. The cut value is .500

From Table 5, the model correctly classified 80.5 percent of cases overall. In other word, this is the rate of correct classification if we always predict that a respondent would choose electronic medium. The specificity of this model is 90.6%. The sensitivity for the model is 62.1%. Overall, the accuracy of the rate was very good, at 80.5%. The model exhibits good sensitivity since among those persons who will choose electronic medium over printed medium, 66.7% were correctly to choose electronic medium based on the model.

Table 6 Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1 ^a	ISE	.024	.516	.002	1	.963	1.024	.372	2.816
	PU	.697	.500	1.945	1	.163	2.008	.754	5.346
	PEOU	-1.380	.349	15.622	1	<0.01	.252	.127	.499
	EB	.319	.602	.280	1	.596	1.375	.423	4.472
	Constant	-.329	3.036	.012	1	.914	.719		

a. Variable(s) entered on step 1: ISE, PU, PEOU, EB.

The next relevant output which is variable in the equation. It shows the estimated coefficients for Internet Self-efficacy (ISE), Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Environmental Behaviour (EB) and constant under the columns heading B.

Odds is the ratio of probability, usually called as odds ratio (OR) and is given in the column Exp(B) on the table. Table 6 shows the relationship between the predictors and the outcome. B(Beta) is the predicted change in Log Odds – for 1 unit change in predictor, there is Exp(B) change in the probability of the outcome. The beta coefficient can be negative or positive, and have a t-value and significance of the t-value associated with each.

The logistic regression result is shown in table 4.25. The table indicate that perceived ease-of-use is significantly associated with e-textbook selection ($p < 0.05$), thus supporting hypotheses H_{1c} . However, H_{1a} , H_{1b} and H_{1d} are not supported since there is no variable that have significant value less than 0.05. Hence, the perceived ease-of-use is the factor that are most strongly associated with a student's choice of medium electronic.

The odds of a student choosing electronic medium due to perceived ease-of-use is 0.252 times higher than those who choose printed medium which is due to Perceived Usefulness with a 95% CI of 0.127 to 4.99. The confident interval doesn't cross 1 which means that both values are greater than 1. This is important because value greater than 1 means that as the predictor variables increase, so do the odds of selecting electronic medium. Values less than 1 means that as the predictor increases, the odd of choosing electronic medium decreases.

Table 7 Model summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	76.288 ^a	.309	.424

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- a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

The model explained between 33.0% (Cox & Snell R square) and 46.8% (Nagelkerke R square) of the variance in the dependent variable and correctly classified 80.5% of cases. As shown in Table 7 significantly contributed to the model.

Discussion

Ease of use of e-textbook features is identified as the factor that contribute of a student in choosing electronic medium for their academic reading text from the full analysis. This align with the result obtained by Terpend *et al.* [11]. Students are more likely choose e-textbook as their preferred reading medium if they perceive that using e-textbook are easy.

Conclusion

E-textbook and printed textbook preference may vary depends on students. Even so, students should be encouraged to use e-textbook because the features can create more engaged reading that can contribute to greater understanding for them. However, maybe there are a number of factors that influence the majority of the students more prefer to use printed textbook compared to digital e-textbook in their education. Therefore, it is important to seek feedback from student about their experiences with e-textbooks and use it to drive continuous improvements in usability, functionality, and content. The usage of e-textbook need to be empowered not only among the students, but also the educators. On the other hand, education system through digital platform can be widen and then maybe create other transformation in order to ensure a quality education can be achieved. However, this revolutionary learning process involves cooperation between publishers, educational organisations, teachers, and students. Therefore, it is crucial for all parties involved to take part in the adaptation and delivery of e-textbook materials in order to fully utilise the beneficial effects of e-textbooks.

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