E-BOOK AND UNDERGRADUATES' LEARNING OF STATISTICS: A MALAYSIAN PERSPECTIVE

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Universities are trending toward electronic books (e-books) as instructional materials, gradually displacing the traditional print books. However, there seems to be an incomplete body of knowledge on which e-books presentation formats students prefer, particularly when learning statistics. This paper reports the findings of a research conducted to investigate the effects of three e-book formats namely, text and static image (T&S), text and animation (T&A) and text and multimedia (T&M) on student achievement in a first year undergraduate statistics unit at a private university in Malaysia. The e-book used in this study was designed and developed based on Clark and Mayer's (2011) multimedia principles and Cognitive Theory of Multimedia Learning. The findings showed that the use of the different e-book formats had significant effect on student achievement in the statistics unit. The students using the T&A and T&M e-book formats as instructional materials had higher scores in the unit assessment compared to those using the T&S e-book format. In addition, positive learning experiences and higher preferences for using the e-books were also reported by the students using the T&A and T&M e-book formats. These findings indicate that aspects of e-book design need to also be considered when adopting e-book as instructional materials for learning.

Keywords: Achievement; animation; cognitive theory of multimedia learning; electronic books; statistics; multimedia; text and image.

1. Introduction

Rapid technological advancement and its application in education over the past decade have changed the way instructors deliver and learners acquire information (Foasberg, 2011). Information is no longer restricted to only print textbooks as in the past. Print textbooks are gradually being replaced with electronic books (e-books). E-book can be defined as a book presented in electronic or digital format, either on dedicated e-book readers such as Apple I-Pad (Smith & Kukulska-Hulme, 2012), Amazon Kindle E-book Reader (Lebert, 2009), or undedicated devices such as tablet PCs, laptops, desktop (Genuth, 2008; Lebert, 2009) and mobile phones (Uluyol & Agca, 2012). E-book is considered as an emerging technology and currently of interest in higher education setting, especially in the context of e-learning (Appleton, 2005; Baumann, 2010; Foasberg, 2011; Lonsdale & Armstrong, 2010; Miller, 2010; Rothman, 2006; Wong, Liong, Lin, Lower, & Lam, 2011). Appleton (2005) observed, "With printed textbooks being well integrated into traditional teaching and learning in higher education, the next obvious resource to embed into e-learning would be the e-book" (p. 56). Rothman (2006) agreed, "If ever a promising technology existed for education, and e-learning in particular, it would be e-books" (p. 1).

Major publishers are also interested in promoting and supplying electronic versions of higher education books. McGraw-Hill Education has 95% of their books published both electronically and in hardcopy (Warren, 2009). In 2013, it launches its SmartBook, an interactive and adaptive e-book for tablets, desktops and laptops with voice instruction, offering tutoring and highlighting information to ease learning (Empson, 2013). Kno (www.kno.com), an education software company, promotes its newest software of KnoMe for e-book, where students can "check-in frequently to see near real time stats on their study behavior, interaction levels, time management and personal progress" (Trew, 2013, para 2). The software also includes features for social sharing, enabling learners to engage in group discussion activities.

A number of universities have already initiated the move toward becoming a "bookless" institution of higher learning (Ghaebi & Fahimifar, 2011). By doing so, their learners would be able to obtain up-to-date information and be connected to the Internet with ease. E-book adoption by universities in Malaysia, particularly by the university libraries, began in 2002. The first university to adopt e-book as part of their library collection was the Open University of Malaysia (OUM) in June 2002. This was followed by the University of Malaya (UM), the University of Science Malaysia (USM) and the University of Putra Malaysia (UPM) in 2008 (Ismail & Zainab, 2005; Letchumanan & Tarmizi, 2011). Recognizing the need for e-book adoption by Malaysian higher education learners, the Malaysian Ministry of Education has allocated more than RM1.04 million to finance university libraries' subscription to the netLibrary in 2010 (Letchumanan & Tarmizi, 2011).

There are a number of e-books presentation formats – electronic textbooks, electronic static picture books, electronic animated books, electronic talking books, electronic multimedia books, electronic intelligent books and electronic space books (Ghaebi &

Fahimifar, 2011). According to Clyde and Delohery (2005), the format frequently used is the static images with text. In academic libraries, however, the commonly found e-book formats are electronic textbooks, electronic animated books and electronic multimedia books (Foasberg, 2011).

E-books can be tailor-made and customized by instructors (Wong et al., 2011). To ensure that their use would have significant effects on students' learning, the formats and the design of the e-books chosen need to be reflective of the students' learning needs as well as their learning preferences. Findings from research on learning sciences, specifically on how to scaffold learning using technology and how to engage students in their learning process should be accounted for when designing e-books for learning or adopting its use as instructional materials.

2. Review of Related Literature

The first discussion of e-book as an alternative to traditional print began in 1971 with the inception of Project Gutenberg, a digital library for books from public domain which, at present, offers more than 30,000 free public domain e-books through the Internet (Foasberg, 2011). The spread of the Internet in the 1990s results in more books published in digital formats (Baumann, 2010). The use of Hyper Text Markup Language (HTML) compiler enables e-books to act like web pages, making it possible to create a new learning experience for users (Lai & Newby, 2012). E-book should leverage on dynamic visual and verbal formats such as animation and multimedia rather than become reliant on text and static images (Li, Chen, & Sheng, 2013; Richardson, Smith, Lenarcic, McCrohan, & O'Hare, 2010; Warren, 2009). Dynamic visual and verbal formats which encompass static words, images, audios, videos, and animations could move students from assuming a passive role to a more active one, enabling them to be more engaged in a creative and constructive learning experience (Baumann, 2010; Lai & Newby, 2012).

Findings from recent studies investigating effect of different presentation formats on learning achievement seem to indicate that the use of multimedia promotes better learning experience. Zheng, McAlack, Wilmes, Kohler-Evans, and Williamson (2009) found that students understand better when watching animated images which are accompanied with auditory explanation compared to simply watching animated images while verbally reading an onscreen-text explanation. Kuhl, Scheiter, Gerjets, and Gemballa (2011) also reported that learners are more engaged and gain deeper understanding when animated or dynamic and static visualizations are used. Similar findings were also reported by Mason, Tornatora, and Pluchino (2013); they found that better performances in science were observed among their students when graphics were used with text as instructional materials.

The e-books used in this study were designed based on Mayer's (2009) Cognitive Theory of Multimedia Learning (CTML) and Clark and Mayer's (2011) multimedia principles. The multimedia component used in the e-books include a combination of text, audio, animation, video, still images and interactive content. There are three assumptions of CTML - (a) Working memory is made up of a dual modality input channel system; (b)

Working memory has a limited capacity; and (c) Learners engage actively in processing learning materials. Dual modality refers to the use of dual channel of representations (verbal and non-verbal) to process information, which is argued to be better than the use of a single channel in enhancing learning experience (Mayer & Moreno, 2003). Each channel has a certain capacity for information processing in working memory, where verbal and visual channels can each only process a certain amount of information at one time (Mayer, 2001). The last assumption highlights the need for learners to be engaged in active processing, and for this to happen, the design of the instructional materials must take into account learners' prior knowledge and linking it with the new information in an organized manner so that the information obtained can be transferred into their long term memory.

Based on the CTML assumptions, Clark and Mayer (2011) further developed seven multimedia design principles, five of which were applicable in the design of the e-books used in this study. These principles are (a) Multiple Representation Principle: Learners learn more deeply from a combination of words and pictures than from words alone; (b) Contiguity Principle: When giving a multimedia explanation, words should be located near the corresponding pictures, rather than farther away from them, (c) Split-Attention Principle: Learners learn more deeply when the text are presented with auditory narration rather than written text; (d) Coherence Principle: When giving a multimedia explanation, a damaging effect on learning occurs if interesting but irrelevant words and pictures are added to the learning materials; and (e) Personalisation Principle: Students learned better by hearing text in an informal, conversational style compared with a formal style.

The use of e-books for learning has indeed generated much interest among instructors and students (Guan, 2009). Existing research on e-books have focused on aspects of their use and usability, including patterns of use, e-book users' level of satisfaction, awareness of and attitude toward e-books, and e-book projects such as Virtual Book or Hyper-Textbook projects (Ghaebi & Fahimifar, 2011; Letchumanan & Tarmizi, 2011). However, there is still a need for research that investigates students' experiences with different e-book and media formats (such as text, static images, animation and multimedia) and whether these e-book formats affect the students' level of achievement (Baumann, 2010; Lebert, 2009; Neumann, Neumann, & Hood, 2011).

3. Purposes of The Study

Despite a great amount of writings devoted to media formats which were used pervasively in education (Guan, 2009; Kuhl et al., 2011), there were still debates on which format can enhance learning, particularly in e-book. Hence, this research aimed to investigate the effects of three e-book formats on students' achievement in statistics. The three e-book formats are text and static image (T&S), text and animation (T&A) and text and multimedia (T&M). The content of the e-books focused on the use of a graphic calculator (Ti-83 model) for an introductory statistics course. The study also investigated user's preferences and usage of the three e-book formats.

4. Research Methodology

4.1. *Site and sample*

The study was carried out at an Australian university branch campus in Malaysia. It involved a 12-week learning session in a first year undergraduate statistics course. The participants of this study (N = 89) were enrolled in the statistics subject of Quantitative Analysis for the Bachelor of Commerce program and constituted a homogeneous sample in terms of age. Majority of the participants were local (Malaysian) with a ratio of 7:1 local to international students. The international students were from Bangladesh, Indonesia, Sri Lanka and Pakistan, to name a few. It was assumed that the participants had similar background knowledge in statistics and were new to using Ti-83 graphic calculator and e-book in statistics learning.

Participation in the study was voluntary and there were no extra credit or inducement given. Once the students were allocated into tutorial groups at the beginning of the semester through self-selection in the Allocate+ system, each tutorial group was then assigned to one of the three e-book formats designed for the purpose of this study. Each participant was also given a notice of Consent Information Statement beforehand and indicated agreement to participate in the study before it commenced.

4.2. *Research design*

This study used a quantitative quasi-experiment with non-equivalent group, posttest-only control group research design. Pretest was not included in the study as the students enrolled in this statistics course had not been taught to use Ti-83 calculator in their previous study, and control and treatment group sizes remained constant throughout the duration of the study. Therefore, the posttest-only design was appropriate for this study (Gay & Airasian, 2003). A summary of the demographic characteristics of the participants is presented in Table 1.

Table 1. Participant distribution of each e-book format group of the study.

Demographics Variables		T&S		T&A		T&M		Overall	
		N(30)	%	N(29)	%	N(29)	%	N(89)	%
Gender	Male	11	36.7	18	60.0	13	44.8	42	47.2
	Female	19	63.3	12	40.0	16	55.2	47	52.8
Commerce Major	Accounting	14	46.7	11	36.7	11	37.9	36	40.4
	Marketing	5	16.7	8	26.7	6	20.7	19	21.3
	Human Resource	1	3.3	0	0.0	0	0.0	1	1.1
	International Business	4	13.3	7	23.3	3	10.3	14	15.7
	Others	6	20.0	4	13.3	9	31.0	19	21.3
Computer Usage	Less than 5 years	6	20.0	3	10.0	4	13.8	13	14.6
	More than 5 years	24	80.0	27	90.0	25	86.2	76	85.4

4.3. *The e-book formats*

The e-book formats used in this study were Text and Static image (T&S), Text and Animation (T&A), and Text and Multimedia (T&M). The T&S format was assigned to the control group whereas the two treatment groups used the T&A and the T&M formats. The following presents a brief description of each of the formats used.

Text and Static Image (T&S) e-book

This e-book basically contained static text, pictures, graphs and other static illustrations which were scanned from the statistics paper-based textbook. A screen shot of this e-book format is presented as Figure 1.

Text and Animation (T&A) e-book

This e-book included text and animated interpretation of the Ti-83 graphic calculator. A hyperlink [Animation] was shown next to the explanation of the subtopic and when clicked, a new Window would show a step by step animated version of Ti-83 graphic calculator, based on the statistics functions. This is shown in Figure 2a. The T&A e-book allowed learners to follow the steps of using Ti-83 graphic calculators by clicking the "Next" button. The animation contained a graphic interpretation with visual elaboration of a Ti-83 graphic calculator as shown in Figure 2b.

Figure 1. Screen shot of T&S of the e-book.

1.2.5. The Present Value of an Investment

The Present Value (PV) of an investment is the amount that should be invested now (this is a cash outflow and hence a negative value in the graphics calculator) to generate a future lump sum, given the interest rate per annum, the compounding period and the term of the investment. It is typical of an investment strategy for money that will hopefully grow into a larger amount to be used for future spending or for non-cash investments such as property.

Example 1-6

(a)   How much would have to be invested now to accrue to $100,000 in 10 years if the interest rate was 7.25% p.a. compounded daily.

Solution

a)

	Using Graphics Calculator to calculate Present Value of an Investment [Animation]	
Step 1: Enter Information in **TVM Solver**	Display the FINANCE CALC menu and then select 1:TVM Solver. Enter the information as shown in the screen on the right. Note that the decimal places have been set to 2, using the ＿ function. Ensure that on the PMT: line END is selected.	N=10.00 I%=7.25 PV=0.00 PMT=0.00 FV=100000.00 P/Y=1.00 C/Y=365.00 PMT:END BEGIN
Step 2: Solve for PV.	Move the cursor to PV and press ALPHA **SOLVE (press the ENTER key to find the** Present Value. The answer is $48,435.94; the negative sign indicates a cash outflow.	N=10.00 I%=7.25 PV=-48435.94 PMT=0.00 FV=100000.00 P/Y=1.00 C/Y=365.00 PMT:END BEGIN
	In practice interest rates would not stay fixed over a ten-year period unless it was a special arrangement.	

Figure 2a. Screen shot of an [Animation] hyperlink on the e-book.

Figure 2b. Screen shot of a T&A image of the e-book in a "pop-up" window.

Text and Multimedia (T&M) e-book

The T&M or video presentation was similar to the T&A e-book format, with a hyperlink [Video] inserted next to the subtopic explanation on how to use the Ti-83 graphic calculator. When the hyperlink [Video] is clicked, a "pop-up" Window would show a video with audio presentation, assisted by animated version of Ti-83 graphic calculator. This is shown in Figure 3.
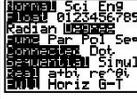
	Preparing the Graphics Calculator [Video]	
Step 1: Home Screen	Press the ON key at the bottom left hand corner. The first time the calculator is used the display opens on the home screen. There may or may not be anything in the home screen. If there is you can clear it by pressing the CLEAR key, 3rd row, right hand side. In this screen you can perform arithmetic calculations. It will also display the output from some of the calculator programs.	
Step 2: Setting the number of decimal places to 2.	Press the MODE key. Use the blue cursor keys to move the cursor down to the word Float and then to the number 2. This sets the number of decimal places to 2. This is suitable for sums of money but for calculations involving other quantities such as interest rates more decimal places may be needed.	
Step 3: Enter Key	Press the ENTER key at the bottom right hand side. This key works like the ENTER key on a computer. The cursor will flash on the 2. This sets the display to two decimal places.	
Step 4: Returning to home screen	Press 2nd key, then QUIT (press the MODE key).	

Figure 3a. Screen shot of a [Video] hyperlink on the e-book.

Figure 3b. Screen shot of a T&M image of the e-book in a "pop-up" window.

4.4. *Research instruments*

The two treatment groups were assigned to the T&A (X_{T1}) and T&M (X_{T2}) e-book formats respectively while the control group was assigned to the T&S e-book format (X_C). There were 30 participants each in the T&S and T&A e-book format groups and 29 participants in the T&M e-book format group. A summary of the research design used in this study is presented in Table 2.

Table 2. Summary of non-equivalent group, posttest-only design.

Groups	Treatment Groups	Data collection
Group 1	Control (X_C)	$O_1 \to O_2 \to O_3$
Group 2	Treatment (X_{T1})	$O_1 \to O_2 \to O_3$
Group 3	Treatment (X_{T2})	$O_1 \to O_2 \to O_3$

Note: X_C = Text and Static Image, X_{T1} = Text and Animation, X_{T2} = Text and Multimedia,

O_1 = Mid-Semester Test, O_2 = Questionnaire, O_3 = Final Examination

As shown in Table 2, data for this study were collected using questionnaire (O_2), Mid-Semester Test (O_1) and Final Examination (O_3). Both the Mid-Semester Test and Final Examination also formed part of the posttest data. Questions for the Mid-Semester Test and Final Examination were developed by the subject lecturer. Both posttests consisted of short answer questions. The Mid-Semester Test consisted of 12 questions while Final Examination contained 13 questions. The one hour Mid-Semester Test covered Chapter 1 and Chapter 2; meanwhile the three hour Final Examination covered Chapter 3 to Chapter 8. The Mid-Semester Test carried the weightage of 25% while the Final Examination carried the weightage of 60% of the overall total mark. The remaining marks were allocated in Individual Assignment (15%), which was not considered in this study as Ti-83 graphic calculator was not used to complete this assessment. The Mid-Semester Test and Final Examination papers were marked and the grades of the participants were compiled by the subject lecturer without identifying any participants to the researcher for this research purposes. The researcher did not teach any of the participants in the three groups during the study. The reliability of the two posttests were measured based on Cronbach's alpha values and was considered reliable (Cronbach's α = 0.844).

The questionnaire used in the study had three open-ended questions as shown in Table 3 and all participants were involved in answering the questions. The open-ended questions provided qualitative understanding on students perception on the extent e-book helped or hindered their learning.

4.5. *Data collection procedures*

The study began with the researcher introducing the procedures of the study to the participants during the first week of lecture. During the second week of the study, when

Table 3. Open-ended questions in the questionnaires.

Questions
Looking back on your experience of using the e-book, please share the problems that you have encountered.
In your opinion, is the e-book useful for your learning?
Any other comments that you would like to provide regarding the use of this e-book?

tutorial classes had commenced, the participants were shown how to access the link to the e-book format online. All of the students were reminded to use the e-book to help them understand the usage of Ti-83 graphic calculator in solving the tutorial questions throughout the semester. Besides using the e-book during tutorial sessions, students could learn using the e-book at home but they could only interact with their classmates who were in the same treatment group.

The participants were informed to use the e-book (via website) for the first 6 weeks of the semester to learn how to use the Ti-83 graphic calculator for Chapter 1 and Chapter 2. At the end of the 6 weeks, participants were given the first posttest, Mid-Semester Test. After the Mid-Semester Test, the participants continued to use the assigned e-book. At the end of the semester (after 12 weeks), the participants were given final posttest as part of the Final Examination administered to measure their learning achievement. The results of Mid-Semester Test and Final Examination obtained after grading the exam papers were entered into SPSS. All data were kept anonymous and confidential. The lesson content in the control group and both treatment groups were the same; however, the method of presentation for each of the e-book formats was different.

4.6. *Data analyses*

The data analyses were carried out using SPSS based on the research objectives of the study. A One-Way between groups Multivariate Analysis of Variance (MANOVA) was performed to investigate the difference between the three e-book formats in the two posttests (Mid-Semester Test and Final Exam). Analysis began with evaluation of assumptions. The six assumptions for MANOVA are: (1) sample sizes, (2) multivariate normality, (3) linearity, (4) homogeneity of regression, (5) homogeneity of the variance-covariance matrices, and (6) multicollinearity (Tabachnick & Fidell, 2007).

The open-ended questions survey data provided qualitative understanding of how the students perceived the use of the different e-book formats. This study employed what is generally referred to as theme-centered analysis (Babbie, 2013). It is a technique to extract desired information from data by categorizing the data into meaningful themes (Babbie, 2013). In this study, excerpts in the form of short phrases or sentences were selected and studied. Then, the data were grouped into themes and constant comparative method was used. Maykut and Morehouse (1994) defined constant comparative method as a process of coding the data by category, comparing meanings across categories, refining categories, exploring relationships and patterns across categories and integrating the data. This was followed by the rules of inclusion where statements from the data served as the basis for including or excluding a unit of analysis in the category (Babbie, 2013; Maykut & Morehouse, 1994). Hence, pieces of data would often intersect to make meaningful connections and build categories of relevant information. Table 4 shows the categories related to participants' perception toward e-book formats.

Table 4. Categories, rules of inclusions, and examples for coding the participants' perceptions toward e-book formats.

Categories	Rules of inclusion	Examples
Physical constraint	Participants felt that they were mostly tired, having fatigue, having eye-strain, and having difficulty remembering information especially when using T&S e-book format. This was indicated by comments such as "tiredness", and "dizzy".	"I need to have a computer to open the e-book while having a textbook is easier. My eyes become tired looking at the computer screen for a long time." (Participant A from T&S e-book group) "I have difficulty in recalling what I have read in the e-book and following the video on screen. Sometime I felt like I'm just watching a short movie and my mind wondered elsewhere." (Participant K from T&M e-book group)
Time constraint	Participants felt that it was time-wasting to use e-book to learn statistics which indicated by comments such as "waste time", and "slow".	"I still think printing textbook is better as it saves time. Searching for some information in the e-book is a waste of time and slower. I need to hit the forward button to look for a certain method to use the graphic calculator." (Participant B from T&S e-book group) "I think it is a waste of time to sit in front of the computer and listening to the video. I am somehow discouraged to follow the video all throughout the semester." (Participant J from T&M e-book group)
Onscreen design problem	Participants commented that the navigation of the e-book was difficult to follow and the font sizes were too small for reading especially T&S e-book format. Other indications were phrases such as "difficulty in navigation", "font size too small", "difficult to read", and "design problem".	"I am kind of lazy to access the e-book and to go through the pages. I don't like to click on the page by page to read the e-book. I think textbook is still better for easy access." (Participant F from T&S e-book group) "The font size is too small to read and it is difficult to read from the screen." (Participant C from T&S e-book group)
Positive responses	Participants found the e-book to be a new experience and generally motivated (phrases such as "like", "good", "nice", and "interested") the participants toward using the e-book.	"I like the idea of having video and sound, seem like a lecture within the e-book. It interests me in learning statistics." (Participant O from T&M e-book group) "I think the animation is easy to follow to learn [how to use] the calculator. I find it interesting." (Participant N from T&A e-book group)
Negative responses	Participants expressed their general negative experiences when using the e-books. These were indicated by comments such as "troublesome", "not helping", "difficult to follow", and "boring".	"It's troublesome and the e-book did not help me much in learning." (Participant A from T&S e-book group) "I don't think learning statistics with graphic calculator is going to help in our future (working life) because we may not use it anymore." (Participant G from T&A e-book group)

5. Results

The results shown in Table 5 indicate an improvement in the students' mean score for Mid-Semester Test to the mean score of Final Examination. Both scores had a maximum of 100 marks. The participants assigned to the T&S e-book format scored the lowest in both Mid-Semester Test and Final Examination as compared to participants in T&A and T&M groups who scored almost similar results in both the Mid-Semester Test and Final Examination.

A One-Way between groups Multivariate Analysis of Variance (MANOVA) was performed to investigate differences between the three e-book formats on the two posttests (Mid-Semester test and Final Examination) to answer the research question "Were there differences in the students' achievement in the statistics subject for the three e-book formats?" Analysis began with evaluation of assumptions. The testing for the six assumptions of MANOVA indicated no major violations of these assumptions. Since the sample size was greater than 30, assumptions of normality and equal variances were of little concern (Castellan, 2010). The assumptions of univariate normality were not violated as the test values for Shapiro-Wilk were found to be not significant ($p > 0.005$). The Mahalanobis distance test failed to identify any multivariate outliers as the Mahalanobis distance of all cases was less than χ^2 (3) = 16.27 ($p > 0.005$). The two posttests were significantly related shown by the significant correlation between the two posttests (r (88) = 0.743, $p < 0.005$). Since the correlations among the two posttests were fairly high, the problem of multicollinearity did not exist (Coakes & Steed, 2003). The Box's M statistics test reported a value of 8.76 ($p > 0.005$) and the Levene's test of equality of error variances was not significant ($p > 0.005$) indicating that the homogeneity assumption of the covariance matrices was satisfied.

Results from the MANOVA showed that there were significant differences between the three e-book formats groups for the two posttests ($F(4, 85) = 5.48$, $p < 0.005$; Wilks' Lambda = 0.785; partial $\eta^2 = 0.11$) with the following results for the Mid-Semester Test (F (2, 86) = 9.49, $p < 0.005$, partial $\eta^2 = 0.18$) and Final Examination (F (2, 86) = 10.24, $p < 0.005$, partial $\eta^2 = 0.19$). An inspection of the mean scores (refer to Table 5) showed that (1) participants scored higher in Final Exam than Mid-Semester Test, and (2) there

Table 5. Summary of the posttest outcomes for different e-book format groups.

E-book format groups		Mid-Semester Test		Final Exam	
	N	Mean	SD	Mean	SD
T&S	30	38.70	17.754	50.73	22.690
T&A	30	58.52	17.223	74.83	19.104
T&M	29	53.87	20.170	70.72	24.060

Note.1) T&S = Text and Static Image, T&A = Text and Animation,
T&M = Text and Multimedia, and SD = Standard Deviation.
2) Both Mid-Semester and Final Exam total scores were of 100 marks.

were no difference in Mid-Semester Test and Final Exam scores for participants using T&A and T&M but both T&A and T&M scores were higher than T&S in Mid-Semester Test and Final Exam.

Three qualitative questions from the questionnaire were also posed to the participants after the treatments. In terms of the participants' experiences with problems faced while using the e-book, their problems could be classified as "physical constraint", "time constraint", and "onscreen design problem".

Forty-six out of 53 responses from all three groups indicated "physical constraints" as a problem. The participants felt tired, fatigue and having eye-strain, especially those using T&S e-book format. Twenty-four out of 30 participants from T&S e-book format reported these complaints while twelve out of 30 participants from T&A e-book format and 10 out of 29 participants from T&M e-book format had similar views. The comments regarding onscreen problems while using e-book included:

> *Found it hard to read and eyes are tired and hurt.*
> *Had difficulty in reading from a computer screen.*
> *The e-book looks like the scanned copy of the normal textbook and it makes my head dizzy reading from the screen all the time.*

Thirty-four out of 53 responses in all three e-book formats commented on time constraint issue with 16 responses from T&S e-book group, seven responses from T&A e-book group and 11 responses from T&M e-book group. The usage of e-book formats was considered as time-wasting and some of the participants thought it would affect the time they needed to learn statistics, as illustrated by the comments below.

> *Searching for information in the e-book is a waste of time.*
> *Wasting time clicking buttons and sit in front of the computer.*

Ten out of the 53 responses commented that the design of the e-books was rather limited and the navigation of the e-book was difficult to follow. Some of the comments are shown below.

> *Lazy to access the e-book and to go through the pages.*
> *Don't like to click on the page by page to read the e-book.*
> *The font size is too small to read and it is difficult to read from the screen.*

It could be inferred from the responses that the participants had some problems while using the e-books. Participants felt uneasy reading from the e-books on the computer screen while others viewed it as a waste of time and preferred printed textbooks. Onscreen design problem such as font size and navigation issues could be contributing factors.

Thirty two out of 89 participants gave their views on the usefulness of e-book for their learning with 20 participants expressed positive experiences while 12 responded with negative experiences.

Positive comments from participants include the following.

Interesting to learn statistics with e-book.

Like the animation as it is easy to follow.

Enjoy using the e-book with video.

Negative comments from participants include:

Troublesome to use and e-book did not help in learning.

Difficult to read the e-book.

Prefer an actual book for learning.

On the whole, participants who were using T&M e-book view the e-book usage positively. They found the e-book helped them in learning the usage of graphic calculator and statistics. On the other hand, participants of T&S e-book group, generally commented that the e-book was rather difficult to follow and did not significantly help them in learning.

When providing additional comments on the use of e-book, 38 of the 53 participants that responded reported positive experiences while 15 participants had negative experiences with the e-book. The responses to this open-ended question were similar to those provided earlier. For instance, Participant Q, who commented that the e-book helped to make statistics interesting, gave similar response to the second open-ended question.

The following are examples of positive comments from the participants.

Good to use and not just a boring textbook.

No need to buy a textbook and it is hassle free.

Prefer e-book because can access it anytime using laptop.

Like the video so did not have to read a lot.

The following are some of the negative comments given by the participants.

Animation is not interesting. Needs to be more interactive.

Video and the sound were quite boring.

Learning better reading textbook.

In general, participants expressed positive feedback with regard to their learning experience while using T&M e-book. The participants felt that it was interesting to learn statistics using e-book, in which they had not encountered before. Nevertheless, they proposed that the T&M e-book be improved with better video and audio quality. Although participants in T&A e-book group mostly stated positive comments, they proposed that the T&A e-book could be improved. One of the suggestions is to include features that allow users to interact with the animated graphs and images, rather than just clicking on "Next" button. Lastly, participants who were in the T&S e-book group still showed preferences in printed textbooks.

In a nutshell, positive comments in all the three open-ended questions are encouraging and point toward an acceptance and a certain enthusiasm among the participants, especially in the T&A and T&M e-books usage. The negative comments suggested that the design of the T&S and T&A e-books can be improved upon. Generally, the participants welcome the e-books as a tool for learning statistics.

6. Discussions

The results from the quantitative analyses revealed that achievement differed significantly across e-book formats. The posttest scores clearly pointed to an improvement in Final Examination, signifying that their knowledge in statistics and Ti-83 calculator usage has been enhanced, through participation in the assigned e-book. These observations revealed a consistent trend of progression from the beginning to the end of the instructional term of 12 weeks and participants learned better in statistics by using Ti-83 calculator as the lessons progressed. Possible explanation for the lower scores in Mid-Semester Test maybe due to the amount of time spent to use the assigned e-book format as e-book was introduced for the first time in the statistics course. Although only two chapters were covered in the Mid-Semester Test, participants may have spent more time to learn how to use the e-book as the participants had no prior knowledge of using Ti-83 graphic calculator in statistics before. Additionally, placing students in a new situation to learn statistics, particularly in different media representation in e-books, could have had a confusing and distracting effect on them before they could get used to the new learning environment (Clark & Mayer, 2011).

After 12 weeks of using the assigned e-book, the participants had adapted and became familiar with the e-book, thus putting their efforts on learning statistics and answering the tutorial questions. Moreover, since there were eight chapters in the Final Examination, the participants were pre-informed by the instructor on the difficulty level. Extra lessons were allocated by the instructor to help the participants in dealing with tutorial questions. For additional practice, the participants were allowed to use the e-books outside the allocated tutorial sessions so they could spend more time in practicing the tutorial questions at their own time. This may likely to have positive influence on the higher scores in the Final Examination.

While the results showed that all participants from three e-book formats scored higher in Final Examination than Mid-Semester Test, the measured data implies that participants from T&A and T&M e-book formats attained greater effectiveness in the learning outcome than did the participants who used the T&S e-book format. Such findings suggest that using e-book with animation and multimedia would be more effective for learning rather than using e-book with only text and static image. In other words, using animation and multimedia produced a greater learning outcome (Mayer, 2001). These results were consistent with findings by Paas, van Gog, and Sweller (2010) and van Gog and Rummel (2010), who found that certain learning materials used in different presentation of information were more effective than others based on performance score differentials. For instance, Kuhl et al. (2011) and Chen and Sun (2012) found that

learners scores were significantly better when it came to applying what they had learned after receiving animation multimedia formats rather than a text-only format. Other study by Lee and Rha (2009) also agreed with the results where students who were exposed to interactive materials (animation and video) achieved higher scores in examination than text only materials in a web-based distance education. Furthermore, Wang, Vaughn, and Liu (2011) and Zhang and Zhou (2003) found that achievement is positively correlated with multimedia instruction as compared to traditional instruction.

The qualitative responses from the questionnaire further revealed that students from T&S e-book format faced difficulty with the features of the e-book, particularly when dealing with just text and graphics on the screen. E-book format with such as this has shown to have a negative effect on their learning. This was the same conclusion derived from the significantly lower scores in the achievement for participants in T&S e-book format group. Hence, it was assumed that the participants showed less preference on T&S e-book format based on their comments in qualitative questions and their achievement level. On the other hand, students expressed positive feedback with regards to T&A and T&M e-book formats and their learning experience. This is further shown in their final score for the course in which participants in both T&A and T&M e-book groups scored higher than T&S e-book group. Nevertheless, although participants showed preferences to the T&A and T&M e-book formats, several comments from the participants seemed to indicate preferences for print-textbook.

7. Conclusions

The findings of this study showed that there is significant difference in learning achievement when different e-book formats are used as instructional and learning materials. Considerations for e-book formats should therefore be part of the design decisions especially when there's interest in developing or customizing e-book for specific learners and subject matters. Future research could determine if results differed with other subjects such as, reading-based subjects, and how different e-book formats affect comprehension among students. Although e-books have been available for more than 40 years, research on e-book in formal instruction is still in its infancy. It is hoped that findings of this study could spur further research into some of the issues raised to enrich the literature of e-books (Li et al., 2013; Smith & Kukulska-Hulme, 2012) and to fill in the gap about the use of e-book in the Asian and Malaysian context of higher learning. As more and more higher education publishers transform learning content into interactive materials that leverage on recent technological innovations, the future holds exciting possibilities for e-books usage and adoption for learning.

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