Investigating the Effects of Interactive E-Book towards Academic Achievement

Bibiana Chiu-Yiong Lim[1*], Llewellyn Wee-Ling Liu[2], Chian-Hou Choo[3]

[1]Faculty of Business, Design and Arts, Swinburne University of Technology (Sarawak Campus),
Jalan Simpang Tiga, 93350 Kuching, Sarawak, Malaysia
blim@swinburne.edu.my
[2] Faculty of Engineering, Computing and Science, Swinburne University of Technology (Sarawak Campus),
Jalan Simpang Tiga, 93350 Kuching, Sarawak, Malaysia
lliu@swinburne.edu.my
[3] School of Foundation, Swinburne University of Technology (Sarawak Campus),
Jalan Simpang Tiga, 93350 Kuching, Sarawak, Malaysia
cchoo@swinburne.edu.my
Swinburne University of Technology (Sarawak Campus),
Jalan Simpang Tiga, 93350 Kuching, Sarawak, Malaysia
[*]Corresponding Author
http://doi.org/10.24191/ajue.v16i3.10272

Received: 3 March 2020
Accepted: 11 June 2020
Date of Online Publication: 20 October 2020
Published: 20 October 2020

Abstract: Universities are trending towards electronic books (e-books) as instructional materials, displacing traditional printed books. The rapid acquisition of e-books has changed the way information is presented and one of the improvements is to make e-books interactive. However, there is an incomplete body of knowledge on how interactive e-books affect students, particularly in the learning of statistics. This paper aims to examine the effects of interactive e-books on academic achievement. This paper adopted an experimental approach to test the causal effect of the two types of e-books, namely Traditional E-book (TE) and Interactive E-book (IE) on a sample of undergraduates enrolled in an introductory statistics unit. The experimental results indicated that students who learn statistics through IE produced higher scores in academic achievement than students who learn through TE. The findings of the study first extend the existing theory by showing that TE and IE can account for the variations in academic achievement. The study implied that e-books should not be static and e-book publishers and educators can choose to design their ebooks using interactive formats with animation components depending on available resources. The study offers new insights on how academic achievement of students can be better managed through the design of e-book types.

Keywords: Ebook types, academic achievement, statistics, higher education

1. Introduction

Attending university can be a challenging experience for most of the new undergraduate students as they are facing new demands in the transition from highschool to university (Novel, Ajisuksmo, & Supriyantini, 2019) . The growth of e-books in terms of its numbers and usage has been massively unprecedented (Khalid, 2014; Kumbhar, 2018; Lebert, 2009; Roslina, Fahmy, Yaacob, Haslinda & Fariha, 2012; Tosun, 2014). Indeed, the importance of e-books in higher education has become increasingly prominent due to a shift from physical to blended and digital learning environments (Baumann, 2010; Kumbhar, 2018; Lonsdale & Amstrong, 2010; Neumann, Neumann & Hood, 2011). However, the design and impact of e-books in student academic achievement is an area that lacks adequate understanding. Specifically, this paper contends that there is a lack of empirical knowledge related to the traditional or static and interactive types of e-books and its effects toward

academic achievement in traditionally challenging disciplines, such as statistics (Baumann, 2010; Cavanaugh & Cavanaugh, 2008; Roslina et al., 2012).

The use of technology in teaching and learning in the field of statistics is still new but has been gaining momentum in recent years (Ashcraft & Moore, 2009; Mkhize & Mastry, 2017; Neumann et al., 2011; Pia, 2015). Statistics courses are usually of concern among undergraduate students (Liu, Onwuegbuzie, & Meng, 2011; Perepiczka, Chandler, & Becerra, 2011). This may be caused by students' phobia of statistics, fear of failure and low self-confidence in computing statistics (Mills & Raju, 2011). Hence, researchers have tried to incorporate technology to enhance the teaching and learning of statistics (Everson & Garfield, 2008; Neumann et al., 2011; Schou, 2007; Wang, Vaughn, & Liu, 2011); the use of animation and multimedia is most prevalent (Neumann et al., 2011). Although tools such as graphic calculators and statistical software packages are used to help students in learning statistics (Handal, Cavanagh, Wood, & Petocz, 2011), Ooms and Garfield (2008) suggested that some of the statistics textbooks could be digitized and also be supplemented with more interactive elements in the form of web-based and computer simulation tools which can help students to visualize and understand abstract concepts in statistics.

To date, many researchers have conducted various experiments and have identified the factors that may enhance students' academic achievement. However, little is known about the relationships between traditional and interactive e-book towards students' academic achievement. Thus, this paper aims to investigate the effects of the different types of e-book on academic achievement. By doing so, this paper hopes to shed light on how different types of e-books used accounted for the variations in the academic achievements of students in learning statistics. For the purpose of this study, a printed statistics textbook was scanned and uploaded onto the website as an e-book. Flash animations were embedded into the e-book as it is believed that animation could enhance interaction and stimulate interest among students when learning statistics (Neumann et al., 2011).

2. Literature Review

2.1 E-Books

There were signs that e-books can become a promising resource in education (Foasberg, 2011; Kumbhar, 2018; Lebert, 2009; Tosun, 2014; Warren, 2009). Higher education institutions in Malaysia (Letchumanan & Tarmizi, 2011; Roslina et al., 2012; Shiratuddin, Othman, Ahmad, & Hassan, 2006) and public libraries (Cavanaugh & Cavanaugh, 2008; Ismail & Zainab, 2005) are beginning to explore the application of e-books and e-book readers in online learning environments.

Foasberg (2011) explored the use of electronic textbooks in university settings and found that students preferred additional features offered by e-books than printed textbooks because e-book contain search abilities, text highlighting, and the ability to make notations and to bookmark pages. According to the author, this was one of the reasons why there was a growing number of e-books in university libraries in the United Kingdom. The article also indicated that both universities and publishers realized that the digital content of e-books was a factor, which has contributed to a growing market of users in higher education but the delivery formats and presentation styles preferred by students remained undetermined. Chou (2016) was in agreement with this where his study showed a good number of students who were using e-books but different presentation styles should be considered in order to gain increased usage of e-books in the future. In addition to this, the study conducted by Woody, Daniel and Baker (2010) disclosed a potential market for e-textbooks. A study by Smith and Kukulska-Hulme (2012), and Wu and Hsieh (2016) reported that interactive e-books could be developed with online forum postings, blog posts and wikis in iPads to help distance learning students. A recent study by Kumbhar (2018) suggested that e-books is still an important medium for communication to support interdisciplinary materials.

Hence, when considering the potential for using e-books in education, educators, students, librarians and e-books providers should try to achieve a common understanding of the potential of e-books (Genuth, 2008; Tosun, 2014). Most of the e-book publishers and providers have shown little interest in the needs of users (Baumann, 2010; Kumbhar, 2018; Roslina et al., 2012; Tosun 2014) and

it is suggested that ebook developers should take into consideration the users' perspective when designing e-books.

2.2 Research Findings on Animation

A number of researchers have discussed the benefits of presenting information using animated demonstration as one of the learning tools in an e-learning environment (Baglama, Yucesoy & Yikmis, 2018; Guan, 2009; Tversky, 2011). Animation has been found to be effective and helpful in illustrating instructional roles, including attracting and directing student attention. Since the early 1990s, many studies have been conducted to investigate the effects of animation in different instructional delivery environments, including film, television and computer (Park & Hopkins, 1993; Sirikasem & Shebilske, 1991). Animation has been found to have positive effects on academic performance compared to static graphics in some studies (Guan, 2009; Rieber, 1990) where various visual contents such as animated illustrations, diagrams and visuals, real-time motion graphics, animated 3-D visualization graphics, and animated interactive maps with blinking dots were studied.

Early studies examining the effects of animated visuals on learning can be found in instructional film research that examined the effects of animated visuals on learning (Lumsdaine, Sultzer, & Kopstein, 1961; May & Lumsdaine, 1958). In the 1990s, studies have shown animated treatments may differentially affect students and it was suggested that animation may be the most effective in computer-based instruction when used in interactive graphic applications (Park & Hopkins, 1993; Rieber, 1990). These included the use of pictures, animations, spreadsheets, graphs and other external representations in content. However, Park and Hopkins (1993) cautioned that animated visual displays do not significantly have a superior effect compared to which type of teaching, especially when delivering heavy content. More studies need to be conducted in order to determine the significance of the effects of animated visual displays on learning.

The findings by Baglama et al., (2018) on learning with animations show that the messages of animation need to be clearly shown and that animations should be simple and cover only one message at a time to support students' learning. The findings also asserted that the instructional quality, appropriateness of content structure and students' attitudes in learning are of great importance for learning. This is also supported by a study on the relationship between animation demonstrations and student attitudes (Kainz, Jakab & Kardos, 2013). They noticed that the students faced difficulties in learning when the content structure is inflexible and the browsing of animation demonstration is inefficient. In addition, Kuhl et al. (2011) reported that learners who engaged in animated or dynamic and static visualizations tended to use visualizations more often. These learners also gained a deeper understanding of the physical principles of fish locomotion compared to those who used text-only visuals. The study suggested that animated visualization promotes better learning.

Despite the widespread use of animation, the research conducted so far has failed to confirm its superiority over a static image in improving learning (Hegarty, Kriz, & Cate, 2003; Lin & Dwyer, 2010). Studies have not been demonstrated if or how learners use an animated sequence may present any consequences and significant effect on the learning process. Kainz, Jakab, and Kardos (2013) conducted a study on designing animation as a tool for improving education and they cautioned that animation cannot be used solely as a tool for learning even though animation may lead to an improvement in learning. The effects of prior knowledge and instructors' ability on the effective use of animated visual displays need to be considered as well (Baglama et al., 2018; Kainz et al., 2013).

2.3 Use of Technology in Statistics Learning and Achievement

In terms of statistics education, the use of technology in teaching and learning in the field of statistics has been gaining momentum in recent years (Ashcraft & Moore, 2009; Ferris & Cheng, 2018; Neumann et al., 2011). Statistics courses are usually of a concern among undergraduate students (Liu, Onwuegbuzie, & Meng, 2011; Mkhize, 2019; Mills & Raju, 2011; Perepiczka, Chandler, & Becerra, 2011) and researchers have incorporated technology to enhance the teaching and learning process of statistics (Everson & Garfield, 2008; Ferris & Cheng, 2018; Neumann et al., 2011; Schou, 2007; Wang, Vaughn, & Liu, 2011). It has been known that some technology tools, such as graphing calculators and

statistics software packages are used to help students in the learning of statistics (Handal, Cavanagh, Wood, & Petocz, 2011). Today, with the advancements of technology, the easy access to the Internet and computers, statistics has become a discipline that has evolved with technology and can be conducted via an online learning environment (Ferris & Cheng, 2018).

Moore (1997a) predicted that the use of animated graphics would greatly influence the way of teaching and learning statistics as the statistics instruction is built on strong relationships between content and technology. Since then, software materials were developed to include animation elements, which provides more graphics, greater interactivity, and can enhance conceptual understanding of statistics for students (Keeley et al., 2008; Kim & Gilma, 2008; Neumann et al., 2011).

Ooms and Garfield (2008) mentioned that the digitization of statistics textbooks, supplemented with interactive media in the form of web-based and computer simulation tools can help students to visualize and understand abstract concepts in statistics. A study by Sezgin and Coskun (2016) in teaching statistical concepts revealed that teaching software with animation helped students' understanding. This shows that animation can enhance students' learning and if possible, students should be able to perceive and understand which format of the presentation to be the one aiding their learning process (Mkhize, 2019). However, there is no conclusive evidence on the effect on academic achievement from the reports of educators' use of technology, including computer software, graphics calculators and statistics textbooks in an online learning environment. Hence, this study concentrates on the use of e-books with animation for a statistics unit at the university level.

The use of technology in e-learning can have a positive effect on students' achievement. A number of researchers have found that technology in e-learning leads to greater levels of learning and achievement among students than in traditional face-to-face classes. For example, in the studies exploring the use of web-based learning and face-to-face learning in an introductory statistics course, it was found that students achieved better results with web-based learning compared to traditional classrooms (Wang et al., 2011; Zhang & Zhou, 2003). Although studies have indicated that the use of technology in e-learning can improve students' achievement in statistics courses, this result might not extend to learning statistics from e-books.

3. Methods

3.1 Experimental Design

In this study, the quasi-experimental research design and post-test-only control group design were used, which involves comparisons between the experimental group and a control group. For the experiment, the students enrolled in the statistics course were placed into two tutorial groups. Each treatment group was assigned to different types of e-book where the control group was assigned the traditional e-book (TE) (X_C) and the experimental group was assigned the interactive e-book (IE) (X_T). Students began to learn statistics from the e-book types assigned in their group in the first week of the semester. The statistics content in the control group and treatment group was the same. However, the method of presentation for each of the e-book types was different. As shown in Table 1, the participants self-enrolled into different groups based on their preferences or availability through the university tutorial allocation system, where O represents a process of measurement or observation and X represents treatments that participants received.

Table 1. Summary of the non-equivalent group, posttest-only design

Groups	Treatment Groups	Posttests
Group 1 (n = 30)	Control (X_C)	$O_1 \rightarrow O_2$
Group 1 (n = 30)	Control (X_T)	$O_1 \rightarrow O_2$

Note: X_C = TE, X_{T1} = IE, O_1 = Mid-Sem Test, O_2 = Final Examination

3.2 Instrument

3.2.1 Design of e-books

For the purpose of this study, the e-books were developed based on an introductory statistics unit. The paper-based textbook was scanned and replaced with the e-book version on a locally hosted website. The TE included text pages, static images of figures, diagrams and tables showing the usage of Ti-83 calculator. Figure 1 shows the TE with static images.

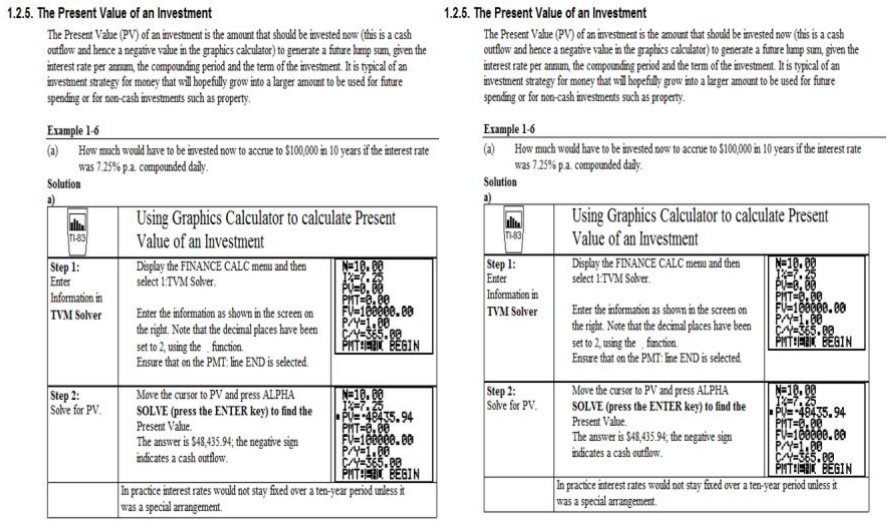

Fig. 1: Screenshot of the pages of the Traditional E-book (TE) (text and static image)

On the other hand, the IE was integrated with interactive Flash animations of the Ti-83 calculator. The IE was designed using the dual coding theory by Mayer (2001) and Paivio (1986) where the explanation was presented both in text and pictures rather than solely in Screenshot. Furthermore, the "pop-up" window with the on-screen content placement reflected Clark and Mayer's (2011) contiguity principle, which suggested that corresponding text instruction was positioned best near the animated graphic described. The animation contained a more realistic graphics interpretation via higher levels of visual elaboration of a Ti-83 graphic calculator. Lastly, in order to help the students to learn statistics better by using the Ti-83 graphic calculator, Clark and Mayer's (2011) coherent principle was applied. For example, the steps of using the Ti-83 graphic calculator were summarized and highlighted in the animation in the IE instead of a longer description (as in the original textbook). Also, the students can monitor their own learning pace by clicking on the 'Next' button in the animation. A shorter yet detailed presentation primes the students to organize the information productively (Chen & Sun, 2012). The screenshots are shown in Figure 2.

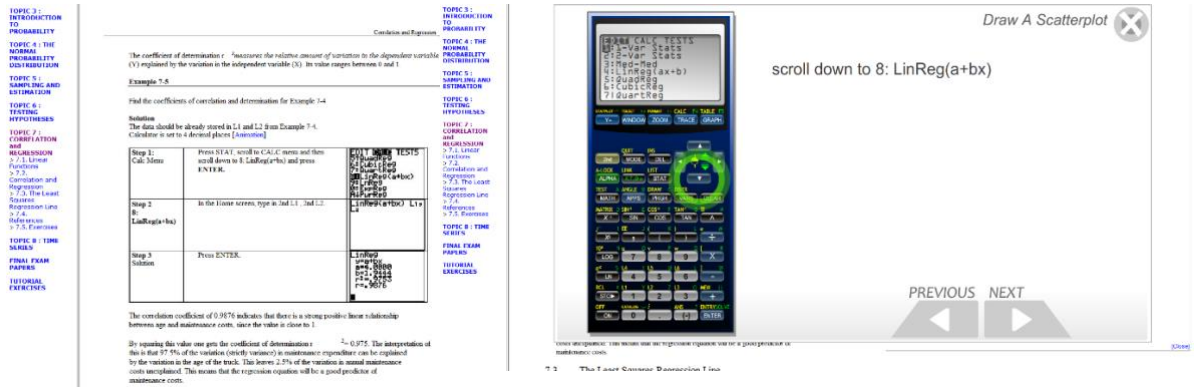

Fig. 2: Screenshot of the pages in Interactive E-book (IE) and the "pop-out" screen showing the animation with text on how to use the graphics calculator.

3.3 Sampling

The participants were 60 first-year undergraduate students enrolled in a first-year statistics unit of a business programme in a private institution in Malaysia. Thirty participants were assigned to TE group (control group) and another thirty participants were assigned to IE group (treatment group).

3.4 Data Collection Procedure

Students enrolled in the first-year statistics unit were invited to participate in this study and participation was voluntary. Each student was given a notice of consent information statement beforehand and indicated agreement by participating in the study before the start of the study. Refusal to participate in the study did not affect the student's grade, as the researcher did not know who had opted out of the study until after all the grades were submitted.

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 graphing calculator for the topics on Financial Mathematics, Descriptive Statistics and Introduction to Probability. At the end of the 6 weeks, participants were given the first post-test, Mid-Semester Test (O_1), in which the students were tested on their knowledge of the topics aforementioned. After the Mid-Semester Test, the participants continued to use the assigned e-book for the rest of statistics topics, for example, Testing Hypothesis, Correlation and Regression. At the end of the semester (after 12 weeks), the final post-test, the Final Examination (O_2) was administered to measure the learners' academic achievement. The results of the Mid-Semester Test and Final Examination post-tests collected and all data collected were kept strictly confidential.

3.5 Data Analysis

The students' academic achievement was determined by the two post-tests, Mid Semester Test and Final Examination. The mean scores for both of the post-tests were checked using the paired t-test for significant differences in both post-tests. The independent variables were the type of e-book used (Traditional and Interactive) and the dependent variables were the two post-tests. A One-way MANOVA was also performed.

4. Results

The variable achievement was measured using the Mid Semester Test in Week 6 of the semester and Final Examination at the end of the 12-week semester as post-tests analyses. The average score of the students for the Mid-Semester Test was 48.61 with a standard deviation of 20.103 while the average score of the students for the Final Examination was 62.78 with a standard deviation of 24.231. The result implied that the participants exhibited higher scores in Final Examination than Mid Semester Test (refer to Figure 3).

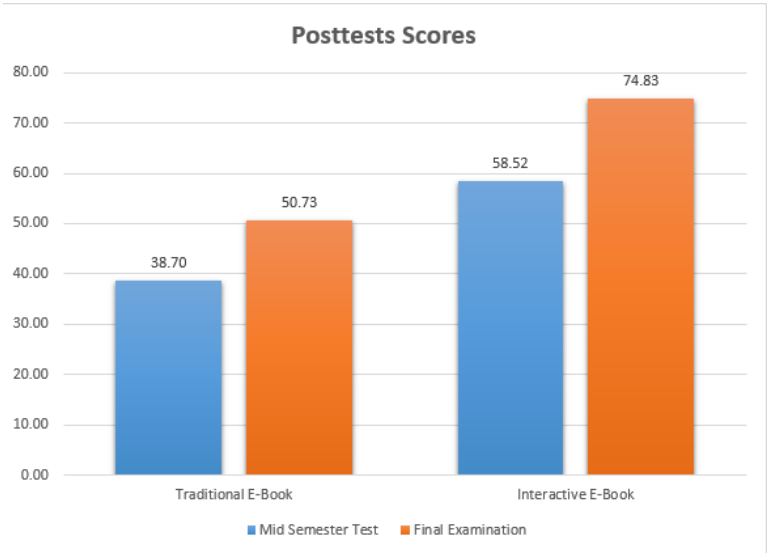

Fig. 3: Posttests scores of mid-semester test and final examination across e-book groups

Table 2. Paired t-tests of mid-semester test and final examination results

Variables	N	Mean	SD	t-value	df	p-value
Mid Semester Test results - Final Examination results	60	-15.042	16.347	-8.681	59	< 0.005*

The paired t-tests indicated that there was a significant difference between the two variables (t (59) = -8.681, p < 0.005). Cohen's d was determined to be the appropriate way to measure effect size in the context of a t-test on means. For these data, the d was calculated to be 0.679, which indicated a large effect size. Generally, 0.2 is indicative of a small effect, 0.5 a medium and 0.8 a large effect size (Cohen, 1988).

Another observation that was noticeable was that from the Pearson Correlation Matrix, the two post-tests (Mid Semester Test and Final Examination) results were correlated well (r (59) = 0.757, p < 0.005). A One-Way between groups multivariate analysis of variance (MANOVA) was also performed to investigate the difference between the two types of the e-book in the two post-tests (Mid Semester test and Final Examination). Results from MANOVA showed that there were significant differences between the two e-book type groups between the two post-tests (F(4, 58) = 5.48, p < 0.005; Wilks' Lambda = 0.785; partial η^2 = 0.11). When the results for the post-tests were considered, Mid Semester Test (F (2, 58) = 9.49, p < 0.005, partial η^2 = 0.18) and Final Examination (F (2, 58) = 10.24, p < 0.005, partial η^2 = 0.19), the significance between the two post-tests scores were indicated.

4.1 Discussion

Encouraging and designing an e-learning course, which includes animation presentation, has been the focus of many studies (Clark and Mayer, 2011; Shaw, 2012). This is because many students typically consider statistics courses difficult (Garfield & Ben-Zvi, 2007). Researchers have tried to incorporate new ways of presenting materials to drive greater statistics learning, particularly in an e-learning environment.

The results from this study revealed that academic achievement differed significantly across the two types of the e-book. The results pointed to a significant improvement over the Mid-Semester Test to Final Examination scores at the end of the semester for both e-book types. This improvement showed

that through using the assigned e-book type, the students' knowledge in statistics and Ti-83 calculator usage have been enhanced. While the results showed that all participants using the two types of e-book scored higher in Final Examination than Mid-Semester Test, the findings also showed that participants using the IE attained higher learning outcomes than the participants using the TE. Therefore, it suggests that using e-book with animation in learning is more effective than using text and static images from e-book. This is consistent with the findings from Neumann et al. (2011), Sezgin, and Coskun (2016). The results support the idea that the information presented in the e-book, especially animation, is beneficial and can improve learning (Chou, 2016; Mkhize, 2019; Wu & Hsieh, 2016). Learners engaged in animated or dynamic visualisations tended to gain deeper understanding and promote better learning, compared to text and static image only (Baglama et al., 2018; Ooms & Garfield, 2008). With proper application of animations, learners will be attracted and their attention will be directed to the content. In addition, the participants may feel excited in using IE, due to novelty effect, which explains the tendency to perform when new technology is introduced, thus resulting in higher achievement if compared to TE. With this, instructors are encouraged to identify which presentation type is more effective in order to provide a supportive learning environment so that the learners can devote their effort and resources to learning.

Nevertheless, many researchers warned about the overuse of animations, which may hinder learning and suggested the proper use of multiple representations of animation to ensure students' learning (Kainz et al., 2013; Wu & Hsieh, 2016). Kumbhar (2018) also pointed out that the withdrawal of printed books might not happen as learners may switch to reading printed books and e-book according to their preferences.

5. Conclusion

The following implications for practice and future research are made for instructors and researchers in the e-learning context. The findings from this study could contribute to the literature and on statistics learning in e-learning platforms. Although e-book is a promising way of learning, especially in higher education, there are still relatively few studies related to e-books. The results of this study have the potential to influence the decision made by both higher education institutions and textbook publishers. The results help to provide educational institutions with information to consider when purchasing e-books for the libraries and for teaching and learning purposes. Since e-books can be customized, instructors and educational textbook publishers can take the initiative of converting printed-textbooks to e-books and embed animation or multimedia to make it more interactive. It is also cost-effective, considering that the conversion of a printed textbook to digital copy does not require high expenses. Additional features, for example, self-quizzes, group sharing and peer-to-peer discussion, which can be integrated into the e-book, are to be examined in the future.

6. Acknowledgements

The authors wish to thank Professor Hong Kian Sam, Associate Professor Norazila Abdul Aziz and Professor Lim Weng Marc for their constructive feedback to improve the quality of this article.

7. References

Ashcraft, M. H., & Moore, A. M. (2009). Mathematics anxiety and the affective drop in performance. *Journal of Psychoeducational Assessment, 27*, 197-205.

Baglama, B., Yucesoy, Y., & Yikmis, A. (2018). Using Animation as a Means of Enhancing Learning of Individuals with Special Needs. *TEM Journal, 7*(3), 670-677. DOI: 10.18421/TEM73-26

Baumann, M. (2010). E-Books: A new school of thought. *Information Today, 27*(5), 42-48.

Clark, R.C., & Mayer, R.E. (2011). *E-learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning* (3rd ed.). San Francisco, CA: John Wiley and Sons.

Cavanaugh, T., & Cavanaugh, C. (2008). *eBook libraries (the whole list)*. http://drscavanaugh.org/ebooks/libraries/ebook_libraries_list.htm. Accessed 15 Sept 2019

Chen, C.M., & Sun, Y.C. (2012). Assessing the effects of different multimedia materials on emotions and learning performance for visual and verbal style learners. *Computers & Education, 59*(4), 1273-1285.

Chou, I.C. (2016). Reading for the purpose of responding to literature: EFL students' perceptions of e-books. *Computer* A*ssisted Language Learning, 29*(1), 1-20.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.

Everson, M.G., & Garfield, J. (2008). An innovative approach to teaching online statistics courses. *Technology Innovations in Statistics Education, 2(*1), 1-18. http://www.escholarship.org/uc/item/2v6124xr. Accessed 25 Sept, 2019

Ferris, M., & Cheng, S. (2018). Using Twitter to Energize the Introductory Statistics Class. *Technology Innovations in Statistics Education, 11*(1), 1-21. https://escholarship.org/uc/item/6207w80h

Foasberg, N. (2011). Adoption of e-book readers among college students: A survey. *Information Technology and Libraries, 30*(3), 108-128. http://www.ala.org/lita/ital/sites/ala.org.lita.ital/files/content/30/3/pdf/ foasberg.pdf. Accessed 14 Sept 2019

Genuth, I. (2008, March 31). *Cybook Gen3 e-book review. The future of things.* http://thefutureofthings.com/articles/1013/cybook-gen3-e-bookreview.html. Accessed 18 Sept 2019.

Guan, Y-H. (2009). A study on the learning efficiency of multimedia-presented, computer-based science information. *Educational Technology & Society, 12*(1), 62–72.

Handal, B., Cavanagh, M., Wood, L., & Petocz, P. (2011). Factors leading to the adoption of a learning technology: The case of graphics calculators. *Australasian Journal of Educational Technology, 27*(2), 343-360.

Hegarty, M., Kriz, S., & Cate, C. (2003). The roles of mental animations and external animations in understanding mechanical systems. *Cognition and Instruction, 21*(4), 411-430.

Ismail, R., & Zainab A.N. (2005). *The pattern of e-book use amongst undergraduates in Malaysia: A case of to know is to use. Malaysian Journal of Library & Information Science, 10*(2), 1-23. http://arxiv.org/ftp/arxiv/ papers /1301/1301.5400.pdf. Accessed 18 Sept 2019.

Khainz, O., Jakab, F., & Kardos, S. (2013). The Computer Animation in Education. *11th IEEE International Conference on Emerging eLearning Technologies and Applications*, October 24-25, 2013, Stary Smokovec: The High Tatras, Slovakia. DOI: 10.1109/ICETA.2013.6674428

Keeley, J. W., Zayac, R. M., & Correia, C. J. (2008). The curvilinear effect of statistics anxiety on test performance: There is an optimal level. *Statistics Education Research Journal, 7*, 4-15.

Khalid, A. (2014). Text Books: ebook Vs. Print. *Journal of Education and Human Development, 3*(2), 243-258.

Kuhl, T., Scheiter, K., Gerjets, P., & Gemballa, S. (2011). Can differences in learning strategies explain the benefits of learning from static and dynamic visualizations? *Computers & Education, 56* (1), 176-187.

Kumbhar, R. (2018). Trends in E-book Research, *Journal of Library & Information Technology, 38*(3), 162-169. DOI : 10.14429/djlit.38.3.12382

Lebert, M. (2009). *A short history of eBooks.* http://www.gutenberg.org /files/29801/29801-0.txt. Accessed 25 Sept 2019.

Letchumanan, M., & Tarmizi, R.A. (2011). E-book utilization among mathematics students of Universiti Putra Malaysia (UPM). *Library Hi Tech, 29*(1), 109-121.

Lin, C., & Dwyer, F. (2010). Effect of varied animated enhancement strategies in facilitating achievement of different educational objectives. *International Journal of Instructional Media, 31*(2), 185-197.

Liu, S., Onwuegbuzie, A.J., & Meng, L. (2011). Examination of the score reliability and validity of the statistics anxiety scales in a Chinese population: Comparisons of statistics anxiety between Chinese college students and their Western counterparts. *Journal of Educational Enquiry, 11*(1), 29-42.

Lonsdale, R., & Armstrong, C. (2010). Promoting your e-Books: Lessons from the UK JISC National e-Book Observatory. *Electronic library and information systems, 44*(3), 185-206.

Lumsdaine, A. A., Sulzer, R. L., & Kopstein, F. F. (1961). The effect of animation cues and repetition of examples on learning from an instructional film. In A. A., Lumsdaine (Ed.), *Student response in programmed instruction* (pp. 241–269). Washington, DC: National Research Council.

May, M. A., & Lumsdaine, A. A. (1958). *Learning from films.* New Haven: Yale University Press.

Mayer, R. E. (2001). *Multimedia learning*. Cambridge, UK: New York: Cambridge University Press.

Mills, J.D., & Raju, D. (2011). Teaching statistics online: A decade's review of the literature about what works. *Journal of Statistics Education, 19*(2), 1-28.

Mkhize, M.V. (2019). Mathematics anxiety among pre-service accounting teachers. South African Journal of Education, *39*(3), 1-14. https://doi.org/10.15700/saje.v39n3a1516

Mkhize M.V., & Maistry S.M. (2017). Pre-service accounting teachers' attitudes to mathematics. *South African Journal of Education, 37*(2): 1372-1384. https://doi.org/10.15700/saje.v37n2a1372

Moore, D.S. (1997a). New pedagogy and new content: The case of statistics. *International Statistical Review, 65*, 123-137.

Neumann, D.L., Neumann, M.M., & Hood, M. (2011). Evaluating computer-based simulations, multimedia and animations that help integrate blended learning with lectures in first year statistics. *Australasian Journal of Educational Technology, 27*(2), 274-289.

Novel, F., Ajisuksmo, C. R., & Supriyantini, S. (2019). The Influence of Processing and Regulation of Learning on Academic Achievement Amongst First Year Undergraduate Psychology Students in University of North Sumatra. *Asian Journal of University Education, 15*(2), 36. doi:10.24191/ajue.v15i2.7555

Ooms, A., & Garfield, J. (2008). A model to evaluate online educational resources in statistics. *Technology Innovations in Statistics Education Journal 2*(1), 1-17. http://escholarship.org/uc/item/5rd175dg #page-1. Accessed 1 Oct 2019.

Paivio, A. (1986). *Mental representations: A dual coding approach.* Oxford: Oxford University Press.

Park, O., & Gittelman, S. S. (1992). Selective use of animation and feedback in computer-based instruction. *Educational Technology Research & Development, 40*(4), 27-38.

Perepiczka M., Chandler, N., & Becerra, M. (2011). Relationship between graduate students' statistics self-efficacy, statistics anxiety, attitude toward statistics and social support. *The Professional Counselor, 1*, 90-108.

Pia, K.F. (2015). Barriers in the teaching learning process of mathematics at secondary level: A quest for quality improvement. *American Journal of Educational Research, 3*(7), 822–831. https://doi.org/10.12691/education-3-7-5

Rieber, L. P. (1990). Using computer animated graphics with science instruction with children. *Journal of Educational Psychology, 82*, 135-140.

Roslina, W., Fahmy, A., Yaacob, A., Haslinda, N. & Fariha, Z. (2012). "Research Directions for e-Book: A Malaysian Perspective". *International Journal of Information Technology & Computer Science, 5*, 1-10.

Schou, S. B. (2007). A study of student attitudes and performance in an online introductory business statistics class. *Electronic Journal for the Integration of Technology in Education, 6*, 71-78.

Sezgin, M , Coskun, M . (2016). The Effects of Multimedia Courseware Design Based on Cognitive Theory of Multimedia Learning on Academic Achievement and Instructional Efficiency. *Cukurova University Faculty of Education Journal, 45*(2), 405-422. DOI: 10.14812/cuefd.284861

Shaw, R.S. (2012). A study of the relationships among learning styles, participation types, and performance in programming language learning supported by online forums. *Journal of Computers & Education, 58*(1), 111-120.

Sirikasem, P., & Shebilske, W. L. (1991). The perception and misperception of architectural designs communicated by video-computer imaging. *Psychological Research/ Psychologische Forschung, 53*, 113-126.

Smith, M., & Kukulska-Hulme, A. (2012). Building mobile learning capacity in higher education: E-books and iPads. In M. Specht, J. Multisilta & M. Sharples (Eds.). Proceedings at the *11th*

World Conference on Mobile and Contextual Learning (pp. 298–301). Helsinki: CELSTEC & CICERO Learning.

Tosun, N. (2014). A Study on Reading Printed Books or E-Books: Reasons for Student-Teachers Preferences. *The Turkish Online Journal of Educational Technology, 13*(1), 21-28.

Tversky, B. (2011). Visualizations of thought. *Topics in Cognitive Science, 3*, 499-535.

Wang, P.Y., Vaughn, B.K., & Liu, M. (2011). The impact of animation interactivity on novices' learning of introductory statistics. *Computers & Education, 56*(1), 300-311.

Warren, J. W. (2009). Innovation and the future of e-Books. *The International Journal of the Book, 6*(1), 83-93.

Woody, W.D., Daniel, D.B., & Baker, C.A. (2010) E-books or textbooks: Students prefer textbooks. *Computers & Education, 55*(3), 945-948.

Wu, K-C. & Hsieh, T-Y. (2016). Affective choosing of clustering and categorization representations in e-book interfaces. *Aslib J. Info. Management*, 2016, *68*(3), 265-285.

Zhang, D., & Zhou, L. (2003). Enhancing E-Learning with Interactive Multimedia. *Information Resource Management Journal, 16*(4), 1-14.