The effect of E-books on Preservice student teachers' achievement and perceptions in the United Arab Emirates

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Abstract

E-books are replacing textbooks at educational institutions worldwide. The effectiveness of e-books depends on factors such as design, interactivity, richness of content, and students' perceptions of the benefits they gain or think they gain. This study aimed to investigate the effect of e-books on learning technological course content and assess preservice student teachers' perceptions of the usefulness of e-books for their course learning. The study used a quasi-experimental, three-group pretest-posttest design with two experimental groups and one control group. The first experimental group used an interactive e-book (an iBook); the second, a non-interactive e-book (a PDF version of the iBook); and the control group, a hardcopy version of the same e-book. Participants were preservice student teachers studying a technology course at the United Arab Emirates University. A post-treatment questionnaire was also administered to all participants. The results did not show any significant difference in achievement of the course content related to the type of the book used. Preservice teachers had a significantly more positive attitude towards the usefulness of the interactive e-book version for content learning than towards other versions and reported more advantages and fewer disadvantages of the interactive version compared to the other versions.

1 Introduction

Technology integration is a comprehensive enterprise that involves multiple aspects. In today's world of higher education, technology integration is one of the essential

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requirements for successful teaching and learning (Almekhlafi and Almeqdadi 2010). When technology is integrated into classrooms, it can save teachers' time, make learning more authentic and meaningful, and enable students to take control of their learning (Almekhlafi 2006a, & Almekhlafi 2006b).

However, technology integration is a complex task that requires educators to consider several factors that influence implementation, including teachers' attitudes, beliefs, and demographic attributes; administrative support systems at schools; accessibility of resources, services, and devices; availability of time; and years of experience (Earle 2002; Brinkerhoff 2006; Inan and Lowther 2010). Teachers integrate technology differently based on not only their beliefs, attitudes, and preferences, but also their students' needs. Some may use technology to communicate, interact with, and assist students to become independent learners; involve them in their learning; help them better understand subject topics; and cooperate with other learners. Others value technology being integrated into classrooms as it saves time and efforts, makes students' learning enjoyable, increases engagement, and fosters different learning preferences (Almekhlafi and Almeqdadi 2010).

Electronic books, more commonly known as e-books, are a form of technology integration for learning subject matter content that have become widespread recently (Moore 2009, 2010; Önder, 2010 as cited in Yalman 2014). Siegenthaler et al. (2010) argued that e-books are designed to take into consideration features that are not available in traditional hard copy books such as adjustable font size and background texts. According to Yalman (2014), e-books were launched and made available to the public in the 1990s, but it took some time for them to be accepted. By the end of the 1990s, especially in 1998, e-books gained widespread use by readers of all sorts of materials. Many of these studies revealed numerous advantages of e-books compared to traditional books (e.g., Huang et al. 2012; Jamali et al. 2009; Melinis 2011; Muthu 2012; Yalman 2014; & Woody et al. 2010). In many cases, students performed better and had a more positive attitude toward the content when using e-books (e.g., Beimers 2014; C-N Chen et al. 2013; Quan-Haase et al. 2014; Sackstein et al. 2015; Stickles 2015).

1.1 Significance of the study

Technology integration has become an important aspect of effective classroom environments. With the advancement of technology, including hardware and software, such integration could push teaching and learning to a higher level. The adoption of e-books to replace normal textbooks is a common strategy occurring worldwide.

Despite the fact that the integration of e-books into the education system of the Arab world is not highly prevalent, a study of the effect of e-books on learning could enlighten and empower stakeholders to give this issue the importance it deserves. The findings of this study might create awareness among higher education administrations, teachers, students, supervisors, and decision-makers, urging them to pay more attention to incorporating e-books into education systems across the Arab world to reach to a level comparable to that of advanced countries.

Although many teachers are still unsure of which is a more effective tool for student achievement (e-books or printed books), many studies have been conducted regarding this issue. In recent years, the integration of e-books into schools' curricula and at higher education institutions has been noteworthy. Many studies have investigated the use of e-

books in different educational majors across the globe. They have been used across different subjects, including language, science, and math.

1.2 Theoretical framework

Media richness theory (MRT, also known as the Information Richness Theory) is used as the theoretical framework for this study. Daft and Lengel (1986) introduced MRT for the first time in 1986. It suggests that the richer the communication media, the more effective the learning. According to Daft et al. (1987), the richness of the media is based on four criteria:

1. Instant feedback received by students;
2. Multiple transmitted cues such as physical presence, body gestures, images, and voice;
3. Variety of languages used for conveying the meaning to students; and
4. Ability of the medium to convey a personal focus such as feelings and emotions.

It might be worth mentioning here that the e-book used in this study was developed based on the Almekhlafi 2018, Almekhlafi 2019, and Almekhlafi 2020) that has been validated and is being applied in a different context (Fig. 1).

1.3 Operational definitions

Educators have attempted to define e-books based on various contexts. Some define e-books as electronic forms of books that are published on the Internet for readers or digital versions of books that include multimedia and can be displayed through different devices (Muthu 2012). Similarly, Onder (2010, as cited in Yalman (2014) views e-books as transferring hard copy books to digital forms that can be accessed on electronic devices. One definition of e-books states that they are electronic versions of printed books that have multiple features, which pose several interesting challenges to readers. Another defines them as digital books that are designed in electronic environments by integrating both versions of software and hardware (Yalman 2014).

E-books can be designed and published in various formats, from basic texts to more advanced versions that include multiple features. They are also known as digital books or as electronic versions.

In this study, e-books refer to the digital versions of an educational technology course textbook. These e-books were created using iBooks Author Software for iOS, and saved as two versions: an interactive book (an iBook) and non-interactive (a PDF) file. The hard copy textbook refers to the print of the e-book PDF version, which is based on the textbook used for the course. In summary, the three versions used in this study are an interactive e-book (referred to as *I.V.*), a non-interactive version (referred to as *N.V.*), and the hard copy (referred to as *H.C.*).

1.4 Problem statement

It has become clear that over the past few years, schools and higher education institutions worldwide have begun adopting e-books, and the Arab countries are no
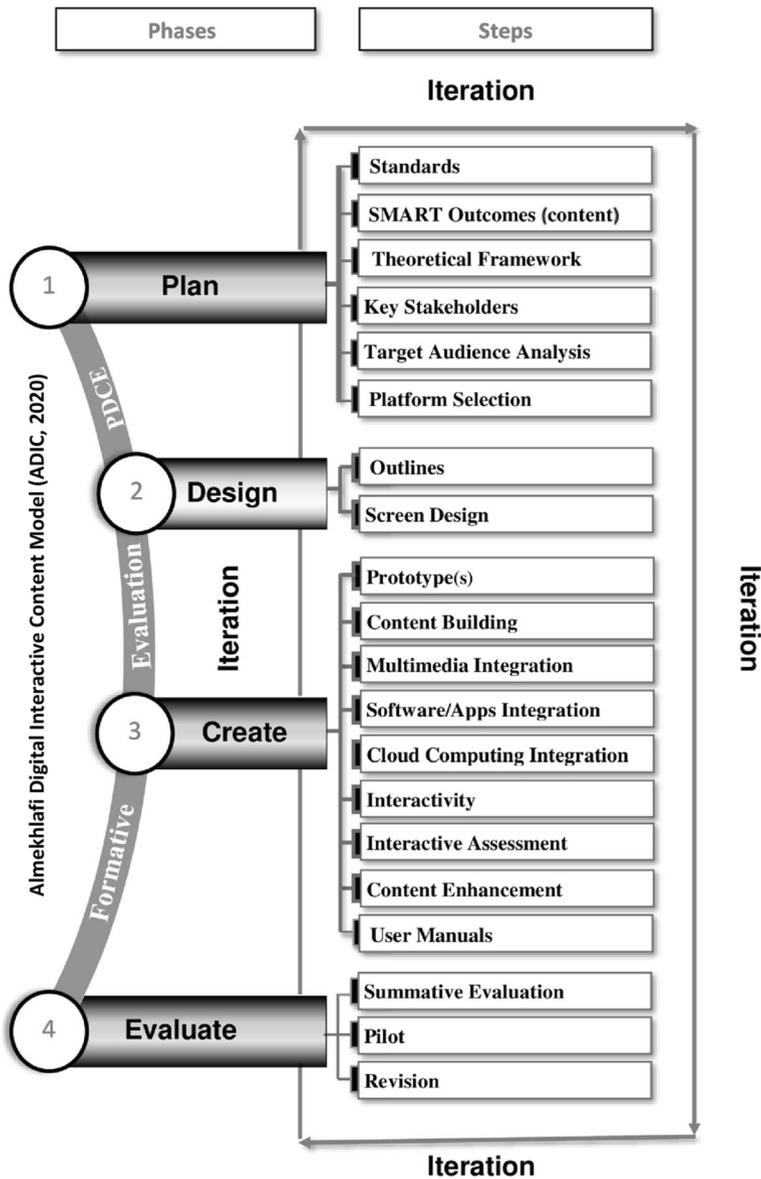
Fig. 1 Almekhlafi Digital Interactive Content model

exception. Many are using e-books instead of hard copy textbooks. However, the adoption of e-books in Arab countries, in general, and in the United Arab Emirates (UAE), in particular, is still in its early stages.

The UAE has launched many initiatives to use up-to-date technologies. The iClass adapted by Abu Dhabi Education Council (ADEC, which was recently renamed Abu Dhabi Department of Education and Knowledge, ADEK) is an example. However, limited research has been conducted to investigate the utility of e-books for teaching and learning and the perceptions of students and teachers

with regard to the utility of e-books in K-12 schools or higher education institutions. Therefore, the need for a study to investigate the utility of e-books for learning content is crucial.

Thus study aims to fill this gap and investigates the effect of e-books on preservice student teachers' achievement of the content of an instructional technology course and their perceptions of the utility of these e-books. The results may shed light on the benefits of e-books for teaching and learning and the contributions they could make to the education system in the Arab world. This study is conducted in a higher education institution; however, other studies (e.g., Quan-Haase et al. 2014) have also showed that e-books are effective even when used to teach school children. Thus, the results might empower stakeholders in the Ministries of Education in Arab countries to adopt strategies and initiatives that speed up the process of integrating e-books in schools and higher education institutions.

1.5 Questions

The main question this study seeks to address is: "What is the effect of e-books on preservice student teachers' achievement of the content of an instructional technology course and what are the teachers' perceptions of their utility?" Three sub questions were formulated:

1. What is the effect of e-books on preservice student teachers' achievement of the content in an instructional technology course?
2. How do preservice student teachers perceive the utility of e-books in helping students learn the course content?
3. Are there any significant differences in perceptions between the preservice student teachers who used the interactive version of the e-book and those who used the non-interactive version?

2 Material and methods

2.1 Settings

This study was conducted at the College of Education, United Arab Emirates University, during the academic year 2017–2018. The course in focus is one of the five core courses taught to all preservice student teachers who enroll in any of the five programs (Elementary, Secondary, Special Education, Foundation, and Physical Education) offered by the College of Education. The researcher was the course instructor for all three groups in the study, which minimized the confounding variables that could affect the study if it involved different instructors. Before conducting the study, all required approvals were obtained from the Social Sciences Research Ethics Committee of the United Arab Emirates University.

2.2 Participants

The participants in this study were 102 preservice student teachers studying educational technology during fall 2017. All study participants were in their first year of college. All participants were females as there were no male students at the College of Education at the time this study was conducted. Their age ranged between 18 and 20 years and all shared the same social and racial background. Based on their own reports, the participants' computer experience ranged between the beginners' level and the advanced level. Participation was voluntary and participants were informed that they could withdraw from the study at any time.

2.3 Design

This study employed a quasi-experimental three-group pretest-posttest design. Of the three groups included in the study, two were experimental and the third was a control group. The purpose was to investigate the effect of e-books on achievement. In addition, a post-treatment questionnaire was used to investigate perceptions toward the utility of these e-books.

2.4 Materials and procedure

Curriculum 101 is a technology core course that has been transformed into a Smart Learning course. One of its features includes the use of e-books for the course

Fig. 2 The e-book cover and screenshots of sample content

materials. Thus, an e-book was developed to encompass all the course outcomes. It was divided into 12 chapters covering the whole semester (See Fig. 2). For the sake of this study, two versions of the same e-book were prepared: an I.V. in the form of an iBook created with iBooks by the author and its counterpart N.V. in a PDF file.

The study lasted two months. First, at the beginning of the fall semester 2017, participants in the three groups took the pretest online and their scores were recorded and stored within Blackboard Learn, the learning management system adopted by the United Arab Emirates University. Second, teaching of the selected course units for the experiment started with all groups covering the same topics, objectives, and following the same pedagogy. Because the professor for all the groups was the same, external variables were neutralized. Once the topic was discussed in the classroom, each group was required to study the materials from the assigned iBook, e-book, or textbook, as discussed above.

Because interactivity is the main component that differs in this treatment, the interactive e-book users were required to use only the iBook to study the materials, complete the exercises, and practice activities. They could watch multimedia files, interact with materials using interactive exercises and assessment questions, annotate and take notes, and check extra resources using the hyperlinks integrated into the iBook.

The second experimental group studied the materials from the e-book in the form of a PDF file. This e-book was the non-interactive version of the one used by the first experimental group. The control group studied the materials from the hard copy version of the required book for the course. Table 1 below shows the features of the different versions used in the study.

Table 1 Criteria that controlled the treatment and study variables

Criteria	Interactive (iBook)	Non-interactive (PDF)	Hard copy
Outcomes /objectives	Cover the same outcomes and objectives across the three versions.		
Materials	Covers 50% of the course content across all versions.		
Teaching pedagogy	The same teaching pedagogy across all groups.		
Instructor	The same instructor for all groups.		
Multimedia	Different types of multimedia elements: images, audio, video, animation, etc.	A limited number of multimedia elements: images and text.	Limited multimedia elements: images and clipart.
Interactivity (see details on this feature below, as it is the most important element in the study)	Very interactive, as it integrates different widgets and styles of hyperlinks and includes interactive assessments and different types of multimedia elements. In addition, an interactive glossary is included in this version.	Interaction is limited to hyperlinks.	NA

2.5 Data collection

This study relied on two instruments of data collection to answer the research questions:

2.5.1 The pretest/posttest

The pretest/posttest was created to cover the chapters selected for the experiment. These chapters included the same ones that were used in a normal semester, without any interference (two months). A total of 50 questions covered about 50% of the materials of the course. The pretest was conducted at the beginning of the semester before covering any content. Two months after the pretest was administered, the posttest was conducted (mid-semester). Both the pretest and posttest consisted of different types of questions, namely multiple choices, true/false statements, and fill-in-the-blanks questions. The computer graded each test out of 100 points, which was the maximum possible score. While there are other important methods of assessment, the various types of questions and the automatic grading for this study were used to avoid any bias in the grading process. Each participant was given a code to use for both the pretest and the posttest for the sake of data analysis, while anonymity was ensured by not disclosing any identifiable information.

The researcher developed the questionnaire based on: (1) a review of previous studies that have investigated the utility of e-books in similar contexts, and (2) the researcher's own experience with e-books and teaching. The questionnaire included several items covering a wide range of categories related to the utility of e-books and comprised two sections: (1) demographic variables including experience with e-books and computer experience, and (2) 56 items investigating participants' perceptions of the utility of e-books. These 56 items covered seven categories: (1) Design/Visual Appeal, (2) Interactivity, Engagement, and Motivation, (3) Navigation/Ease of Use, (4) Content and Multimedia, (5) Assessment and Achievement, (6) E-books' Integration, and (7) General E-book Features.

The questionnaire utilized a 5- point Likert Scale extending from *strongly agree* (5) to *strongly disagree* (1) with midpoints of agree (4), neutral (3), and disagree (2). In addition, the questionnaire had two open-ended questions: The first question asked participants to list the advantages of using e-books, while the second asked them to list any disadvantages they experience. The questionnaire took between 10 and 12 min to complete. It was administered along with the posttest at the end of treatment.

2.6 Validity and reliability of instruments

The pretest/posttest and the post-treatment questionnaire, in addition to the e-books used for the treatment, were all validated and reliability was established.

2.6.1 The pretest/posttest

The validity and reliability of the pretest/posttest were established by three techniques: (1) The questions were drawn from the database that was provided by the textbook publisher, (2) the questions were balanced by using a table of specification,

and (3) the completed test was refereed by a number of content experts in the field of technology.

The pretest/posttest covered different types of questions; namely true/false, multiple choice, and fill in the blanks. The test covered the 6 course outcomes themes namely; technology operations and concepts; planning and designing for effective learning environments; implementation of curriculum plans that include methods and strategies for applying technology; effective assessment and evaluation strategies; productivity and professional practice; and social, ethical, legal, and human issues surrounding the use of technology.

The *reliability* of the test was established by correlating the pretest scores with posttest scores for a sample of 30 participants. Pearson's correlation coefficient between the pretest and posttest was *0.72* at a significance level of *0.01*. As for *internal reliability* of the test, *Cronbach's alpha* for the posttest results of all participants in the three groups was *0.81*, which is higher than the required 0.7.

2.6.2 The post-treatment questionnaire

Once the first draft of the questionnaire was completed, it was sent to a number of professors from well-known universities (e.g., Sultan Qaboos University, United Arab Emirates University, and the Ohio State University) to evaluate its face and content validity. The collected feedback resulted in several changes including format, language editing, and reduction and re-categorization of items. The final version totaled 38 items and 4 categories: Course Content; Design and Navigation; Interaction and Engagement; and Attitude, Motivation, and Preference (see Appendix 2 for the post treatment questionnaire).

Based on a pilot survey of the questionnaire, which was conducted on 49 students with the same characteristics as the study participants, who studied the same technology course, and who used the same e-books in Spring 2017, the reliability using *Cronbach's alpha* was 0.96 (higher than the required 0.7).

2.6.3 The E-books

The e-books used in this study were developed as part of the Smart Learning Project at the United Arab Emirates University. They went through several drafts and evaluation phases to ensure they were of high quality and professional. The Smart/

Table 2 Gain scores of participants as a result of using the e-books and hard copy to study course materials

Treatment	Pretest	Posttest	t.	Sig.	Gain Score
Interactive e-book (iBook)	34	91	20.971	000**	57
Non-interactive e-book (PDF)	37	93	22.705	000**	56
Hard copy (textbook)	40	92	17.269	000**	52

Notes. Mean scores have been rounded off for pretest, posttest, and gain scores

*Indicates that the difference between the pretest and posttest is significant at <0.05

**Indicates that the difference between the pretest and posttest is significant at <0.01

Table 3 Mean scores and standard deviations of the dependent variable (Achievement)

Treatment	Mean	Std. Deviation	N
Interactive e-book (iBook)	90.75	9.04	30
Non-interactive e-book (PDF)	92.78	7.39	33
Hard copy (textbook)	91.86	8.06	34

Mobile Learning Committee at the college level evaluated and approved the e-book for the next level of evaluation. Thus, the two major units (Design Unit and Assessment Unit) of the Center of Excellence in Teaching and Learning at the United Arab Emirates University evaluated and approved the final version. The pilot e-book was introduced during spring and fall of the 2016–2017 academic year. Feedback from students resulted in several changes, such as condensing the materials (from about 400 pages to about 200 pages), enhancing the format, and revising the visual design.

2.7 Data analysis

SPSS 24.0 was used for data analysis. To answer the study questions, three types of statistical analyses were used: First, an analysis of variance (ANOVA) was used to investigate the effect of e-books on learning the content across the three contexts (ANOVA takes the pretest score differences into consideration in the data analysis). Second, descriptive statistics were used to investigate the overall perception of participants across groups. Third, ANOVA was used to investigate any significant differences in participants' perceptions across groups (the study uses 0.05 as the standard of measure for statistical significance).

3 Results and discussion

The results of this study diverge into two different directions. On the one hand, they showed that treatment did not show any significant differences in helping students learn the course content. On the other hand, the results showed very high positive perceptions

Table 4 Results of the analysis of variance (ANOVA) of participants' achievement scores

	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	65.032[a]	3	21.677	.322	0.810
Intercept	88,208.864	1	88,208.864	1308.710	0.000
Pretest	2.927	1	2.927	.043	0.835
Treatment	64.116	2	32.058	.476	0.623
Error	6268.329	93	67.401		
Total	824,400.000	97			
Corrected Total	6333.361	96			

Note. R Squared = .010 (Adjusted R Squared = −.022).

Table 5 Repeated measures ANOVA for students' inter-group achievement with pretest and posttest as the time factor

Descriptive Statistics

	Treatment	Mean	Std. Deviation		N	
Pretest	iBook	34.65	11.95		34	
	pdf	35.62	11.58		34	
	textbook	40.18	14.26		34	
	Total	36.78	12.76		102	
posttest	iBook	62.71	12.57		34	
	pdf	68.35	13.94		34	
	textbook	63.76	18.53		34	
	Total	64.94	15.28		102	

Multivariate Tests

Effect		Value	F	Hypothesis df	Error df	Sig.
Time	Pillai's Trace	0.698	228.320b	1.00	99.00	0.00
	Wilks' Lambda	0.302	228.320b	1.00	99.00	0.00
	Hotelling's Trace	2.306	228.320b	1.00	99.00	0.00
	Roy's Largest Root	2.306	228.320b	1.00	99.00	0.00
Time * Treatment	Pillai's Trace	.038	1.970b	2.000	99.000	.145
	Wilks' Lambda	.962	1.970b	2.000	99.000	.145
	Hotelling's Trace	.040	1.970b	2.000	99.000	.145
	Roy's Largest Root	.040	1.970b	2.000	99.000	.145

of the utility of the I.V. for students learning the course content. Similarly, significant differences were found in participants' perceptions favoring the I.V. In addition, participants reported more advantages and fewer disadvantages for the interactive I.V. compared to the other versions. These results will be discussed below in light of the three research questions.

To answer sub-question 1, *"What is the effect of e-books on preservice student teachers' achievement of the content in an instructional technology course?,"* an
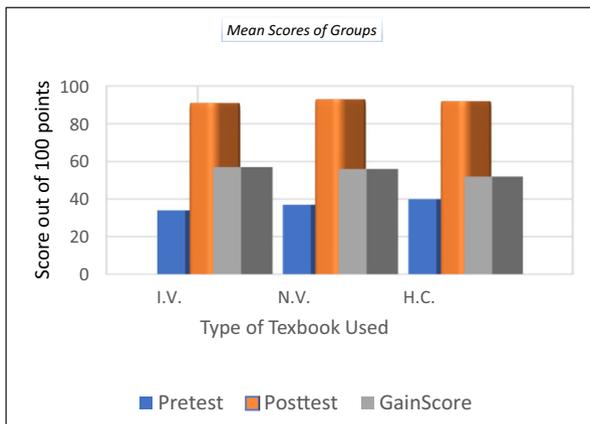

Fig. 3 Treatment and control groups' scores (pretest, posttest, and gain score)

ANOVA was performed to investigate the treatment effect on learning, if any. First, a paired t-test was conducted for each group to determine gain scores and significant differences between pretests and posttest if any. Results showed a prevalent significant gain score for each group. The difference between pretest and posttest scores across groups was significant at the 0.01 level (see Table 2).

As can be seen from the table, the gain score was 57, 56, and 52 for I.V., N.V., and H.C. users, respectively. As the results showed this high gain score between pretests and posttests across groups, an ANOVA was conducted to investigate the effect of treatment on helping students learn the course content (see Tables 3 and 4). Table 3 shows the posttest scores for the three treatment groups with the standard deviations. All groups scored 90% or above in the posttest with a standard deviation ranging between 7.4 and 9.0. However, in spite of this high achievement score, the ANOVA results did not show any significant differences favoring any of the three groups. Therefore, there was no need to run post hoc tests.

For more robust results, repeated measures ANOVA was conducted for students' inter-group achievement taking into account the before-after (pretest and posttest) condition as the time factor. This procedure allows simultaneous comparisons and pinpoints any possible differences in intergroup comparisons. As can be seen from Table 5, the results showed that the means and standard deviation values for the three treatment groups in the pretest were similar. They were also similar between groups in the posttest. This indicates the absence of statistically significant differences between the three groups. This is exactly what the Wilks Lambda repeated measure (time*treatment) results showed (p. 0.145). However, when it comes to the difference between pre and post between groups, the difference is considerable (almost double); thus, we expect to see statistically significant results. This expectation is confirmed by Wilks Lambda showing a significance of 0.05).

The absence of any significant difference in posttest achievement due to treatment contradicts the results of some previous studies. However, it corresponds to some others. For example, Almekhlafi (2006a, 2006b) previously investigated the effects of multimedia on achievement, the findings of which are very similar to this study. The results of these studies favored multimedia over other forms of content delivery platforms. These findings were in alignment with the MRT principles indicating that the greater the use of multimedia elements, the better the learning by users.

Although the I.V. used in this study was expected to result in a significant difference in achievement scores compared to other platforms based on MRT principles, no significant differences between participants' scores due to the treatment were seen. Although the principles of the MRT cannot be ignored as the I.V. users received high scores in the posttest, the results obtained from other groups were also in alignment with MRT principles.

There are possible interpretations for this result: First, participants' posttest scores were very high across all the three groups, which suggest that all students did extremely well. Posttest mean scores were all above 90%: 90.8, 92.7, and 91.8 for I.V., N.V., and H.C. users, respectively (see Fig. 3). This considerably shortened the gap between gain scores and hence did not show any significant differences due to treatment.

Results of this study might draw the attention of stakeholders to the importance of e-books in teaching and learning. In fact, the future of ebooks is promising and the

Table 6 Preservice perceptions of the utility of e-books for learning technology content

Theme/item	Interactive e-book		Non-interactive		Hard copy	
	M	SD	M	SD	M	SD
Course Content: Using this version, I feel:						
Better course outcomes are achieved	4.0	0.9	3.5	1.0	3.8	2.6
Course content is better understood	4.2	0.7	3.6	1.0	3.9	1.1
Course content is organized better	4.2	0.6	3.6	0.9	3.7	1.1
I am comfortable learning the course content	4.1	0.8	3.4	1.0	3.6	1.3
Course content is more appealing to the eye	4.2	0.7	3.2	0.9	3.6	1.3
Academic achievement has increased	3.8	0.8	3.3	1.0	3.8	1.3
Reading the content is more enjoyable	4.3	0.8	3.2	1.0	3.8	1.1
Learning technology terms is quicker	4.3	0.7	3.6	0.9	3.6	1.2
It is easier to read the content	4.4	0.6	3.6	0.9	3.5	1.2
Learning the content is smoother	4.3	0.7	3.5	1.0	3.4	1.3
Learning the content is more meaningful	4.2	0.7	3.4	0.9	3.7	1.2
Content is suitable for special needs students	4.2	0.8	3.5	1.2	3.7	1.2
Design and Navigation: Using this version, I feel:						
It is easier to bookmark, highlight, and annotate text	4.4	0.8	3.4	1.0	3.5	1.1
Chapters and sections are nicely organized	4.5	0.6	3.4	1.0	4.2	0.9
There is good contrast and use of colors focusing on key points	4.5	0.6	3.6	0.9	3.6	1.3
It is easier to use and navigate through the content	4.3	0.7	3.5	1.0	3.0	1.4
Design is more suitable to different learners' needs	4.5	0.6	3.6	0.9	3.2	1.2
Design can match students' various interests and needs	4.3	0.7	3.6	0.8	3.6	1.2
Multimedia elements are clearer	4.3	0.6	3.3	1.0	3.8	1.2
Design is more suitable to various learning styles	4.4	0.6	3.8	0.7	3.8	1.2
Interaction and engagement: Using this version, I feel:						
Interaction with the content has increased	4.2	0.7	3.3	0.9	3.9	1.1
Assessment activities and tests are more engaging	4.2	0.7	3.4	0.9	3.8	1.1
Engagement in learning is higher	4.1	0.7	3.3	1.0	3.5	1.1
This version can develop students' higher-order thinking skills	4.1	0.8	3.1	0.9	3.5	1.2
This version can promote creativity	4.1	0.8	3.1	1.0	3.4	1.1
Students' learning styles are better accommodated	4.3	0.6	3.3	1.1	3.0	1.2
Attitude, Motivation, and Preference:						
My attitude is more positive	4.3	0.7	3.4	0.8	3.6	1.3
I feel more comfortable using this version	4.2	0.7	3.1	1.0	3.8	1.1
Motivation to learn is higher	4.1	0.8	3.5	1.0	3.4	1.1
I recommend using this version in all courses	4.3	0.6	3.3	1.2	3.4	1.2
I wish all courses would use this version	4.1	0.8	3.2	1.3	3.4	1.3
I prefer to take courses that use this version	4.1	0.7	3.1	1.3	3.2	1.3
This version is more desirable	4.1	0.8	3.2	1.2	3.3	1.2
This version is cheaper	4.1	0.8	3.6	1.1	3.6	1.2
This version boosts positive attitudes towards learning	4.1	0.8	3.2	1.1	3.4	1.3
I would recommend others to use this version	4.3	0.7	3.5	1.0	3.7	1.2
This version does not wear out compared to other versions	3.9	0.9	3.2	1.0	3.6	1.0
This version made my learning easier	4.1	0.9	3.4	1.1	3.2	1.3
Total	4.2	0.5	3.4	0.9	3.6	1.3

impact will be tremendous across all fields. It is not a secret that most of the well-known publishing houses have turned into digital publishing or are integrating it systematically into their production. This is confirmed by research coming from digital publishing industry including the publication of ebooks. According to Wastson (2018), digital publishing revenue grew to nearly 18 billion U.S. dollars in the United States in 2018.

Second, the nature of the materials covered in the course may have interfered with the results. The technology course involves numerous hands-on activities performed in the classroom, regardless of the type of treatment. The course not only covers theory and concepts, but also focuses on projects, lab work, and other tasks. Participants across groups might have benefited from the hands-on activities they experienced. If the study was limited to content areas focusing on knowledge and concepts (e.g., math, science, civics, English, and Arabic), results might have been different due to treatment.

Third, the time of the treatment might have played a role in the sense that two months might not have been enough. According to Quan-Haase et al. (2014), the duration of time to cover all materials is one of the major factors affecting the results learning through e-books. Fourth, the effect of e-books on learning might have been different if used for teaching children. Quan-Haase et al. (2014) pointed out that e-books are more suitable for students in primary schools than for students in higher levels of education.

In summary, the answer to question 1 contradicts several previous research findings (e.g., Izzo et al. 2009; Gonzalez 2010; Strout, 2010; Chen et al. 2013; Mana et al. 2014; Abdul Rahman and Ebied 2015, Gentry et al. 2004; and Reid 2016). The results of these studies showed a positive effect of e-books on learning content. They showed that students using e-books had higher achievement scores. In addition, these studies revealed the benefits of e-books for students' learning, as they have interactive, enjoyable, and simulating features and multimedia elements that draw students' interest in the subject matter.

On the other hand, these results conform to those of some other research studies (e.g., Critelli 2011; Stickles 2015; Sackstein et al. 2015), which did not show any significant differences between groups that used e-books and those that did not.

To answer sub-question 2, "*How do preservice student teachers perceive the utility of e-books in helping students learn the course content?*," the results showed that students' perceptions towards e-books was high overall. As can be inferred from the detailed analysis (see Table 6), the mean scores ranged between 3.8 and 4.5 with a total mean score of 4.2 on a 5-point Likert scale for the I.V. Similarly, it ranged between 3.1

Table 7 ANOVA results on preservice teachers' perceptions of the utility of interactive versus non-interactive e-books

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	17.260	2	8.630	12.947	0.000
Within Groups	65.993	99	.667		
Total	83.253	101			

Table 8 Post hoc analysis

(I) Treatment-Control	(J) Treatment Control	Mean Difference (I-J)	Std. Error	Sig.
Interactive e-book	Non-interactive e-book	.99281*	.19802	0.000
	Textbook	.64547*	.19802	0.004
Non-interactive e-book	Interactive e-book	−.99281*	.19802	0.000
	Textbook	−.34734	.19802	0.191
Textbook	Interactive e-book	−.64547*	.19802	0.004
	Non-interactive e-book	.34734	.19802	0.191

Note. Interactive e-book = iBook (I.V.); Non-interactive e-book = PDF (N.V.); Textbook = hard copy (H.C.)

*= significance is <0.5

and 3.8 with an average of 3.4 for N.V., while it ranged between 3.0 and 4.2 with an average of 3.6 for H.C. on the Likert scale. Investigating the table in more detail, results show that participants using the I.V. have higher self-perceptions of its utility in helping them learn the course content than of the other formats. These higher self-perceptions of the utility of the I.V. indicate that participants like to use interactive e-books more than other formats. This might be because of the nature of interactivity that is the main feature of such books. Interactivity and rich multimedia elements make them appealing to users. This is clear from previously conducted studies (e.g., Izzo et al. 2009; Gonzalez 2010; Strout, 2010; Chen et al. 2013; Mana et al. 2014 2014; Abdul Rahman and Ebied 2015; Gentry et al. 2004; Anderson 2015; and Reid 2016). According to these studies, specifically Anderson (2015), e-books create interactive opportunities for students to learn, thereby increasing their ability to remain engaged and feel more connected to their learning.

By investigating the categories and items, it is revealed that the mean score for the I.V. was higher in all categories except for one item in the *Course Content* category. Participants' mean scores for "Using this version, I feel academic achievement has increased," were 3.8, 3.3, and 3.8 for IV, N.V., and HC, respectively. In fact, this result is in alignment with the effect of the treatment. Participants felt they learned the content from all the different versions, and the ANOVA results supported this feeling.

To answer sub-question 3 "*Are there any significant differences in perception between the preservice student teachers who used the interactive version of the e-book and the preservice student teachers who used the non-interactive version?*," a one-way ANOVA was conducted. The results showed significant differences between groups in the individual item subscales with regard to their overall perceptions. Table 7 shows the significant difference in the total mean scores.

To determine the source of significant differences, post hoc tests (Tukey's Honest Significance Difference) were conducted (see Table 8). As can be seen from the table, the significant difference in participants' perceptions was in favor of the I.V. As indicated earlier, the average mean scores for the I.V., N.V., and H.C. were 4.2, 3.2, and 3.7 with a standard deviation of 0.5, 0.9, and 1.3, respectively. A significant difference was found between the I.V. and the N.V. In addition, the same significant

difference was found between the I.V. and the H.C. In both cases, the significant difference was in favor of the I.V.

This significant difference was supported by participants' responses to the open-ended questions in the survey. They were asked to list the advantages and disadvantages of using e-books and/or the hard copy. Responses indicated that they preferred the I.V. over other versions. The most prevalent advantages that emerged from responses were "ease of use," "multimedia elements," and "interactivity" with a frequency of 30, 6, and 4, respectively. Regarding the other versions, only "ease of use" was reported as an advantage with a frequency of 18 for the N.V. and the H.C. versions. These advantages as reported for the I.V. are in alignment with the findings by some researchers (such as Jamali et al. 2009; Melinis 2011; Muthu 2012; and Yalman 2015). No disadvantages were reported for the I.V. with the exception of a participant who mentioned "health problems." This disadvantage that the I.V. "might cause health problems" conforms to what Muthu (2012) and Yalman (2014) found. Both pointed out that e-books have the potential for causing health problems among some users.

This is definitely true as e-books are viewed on computers or mobile devices, which can cause eye strain if used for long periods. In addition, spending long durations on computers or laptops could cause headaches. Similarly, if users do not assume the right posture, neck pain could be another health problem they face. However, these potential health problems could be avoided if users take the necessary safety precautions.

3.1 Study limitations

1. The study was limited to two months. It might have been better to conduct the study over the whole semester.
2. Only female preservice teachers participated in the study due to the absence of male preservice students at the College of Education.
3. Only quantitative data collection tools were used.

4 Conclusions

The use of e-books for teaching and learning is an aspect that has drawn considerable academic debate. The topic has attracted the attention of researchers who wish to investigate the utility of using e-books in place of hard copy textbooks. Researchers have studied the effect of e-books on teaching languages, math, and science, as well as special education students. Many of these studies were in favor of e-books (e.g., Critelli 2011; Stickles 2015).

This study indicated that students positively perceive the utility of I.V. and favor them over N.V. and H.C versions. These results shed light on the importance and application of e-books in teaching and learning environments at different contexts and countries due to their advantages and utility.

4.1 Study recommendations and suggestions

The reviewed studies underscore the importance of using e-books for teaching and learning. ADEK's mission is "to produce world-class learners who embody a strong sense of culture and heritage and are prepared to meet global challenges" (Farah and Ridge 2009). The New Schools Model proposes a new curriculum and a new teaching method, which have been introduced to enhance students' performance by focusing on their development as communicators and thinkers. In addition, learning that is enhanced through digital technology is a crucial component of the New Schools Model. ADEK has initiated many projects and studies to integrate technology in education, with the aim of improving the education system. One of the projects that integrates technology with education is the I-Class project (Badri et al. 2014.

Despite the absence of a significant difference between groups based on the use of e-books, participants showed an interest in e-books and reported several advantages. In addition, previous studies conducted on the effect of e-books on learning showed that they had a greater effect on children's learning than on adults' learning. Thus, several recommendations for stakeholders at ADEK and the UAE's Ministry of Education (MOE) should be taken into account:

1. E-books should be further integrated in all curricula areas and across the different academic cycles in all the seven emirates of the UAE. A special emphasis on this integration should be given to science and math as they depend more on the two prevalent advantages of e-books, namely interactivity and multimedia.
2. ADEK and MOE should provide teachers with adequate professional development activities and training on the development and effective use of e-books.
3. Partnerships with well-known e-books-curriculum development companies should be established. This will facilitate the adoption of high-quality e-books and make it easier and more feasible.
4. Schools should have sufficient technological infrastructure to make the use and application of e-books more effective and accessible to all students.
5. As the use of e-books is becoming more widespread, teachers and students alike should be made aware of the advantages of using e-books for teaching and learning compared to H.C. textbooks.
6. Teachers who are going to integrate e-books into their teaching should undergo enough training on the effective use of technology.

In addition to the abovementioned recommendations, the following areas of research should be investigated to understand the utility of e-books in more depth and across all curricula areas and grades, particularly in K-12 schools.

1. Male versus female research should be conducted to investigate any gender differences in the use of e-books.
2. Research should be conducted across K-12 schools including private and public schools in the United Arab Emirates.

Appendix 2 Post Treatment Questionnaire

3. Research should be conducted to compare the perceptions of both students and teachers on the utility of e-books.

Post Treatment Questionnaire

Code: --------------

Dear participant:

I would appreciate your help in filling in this questionnaire. The aim of this questionnaire is to investigate your perception of the utility of e-books/interactive e-books currently being used in your class. Collected results will be confidential and will be used only for academic purposes.

Demographics:

Experience with e-books: (Yes) (No)

Computer expertise: (1) Beginner, (2) Intermediate, (3) Advanced

Number of hours spent using the computer daily:

Please select the number that corresponds to your belief regarding the utility of e-books/interactive e-books in learning to use the scale:

5 **Strongly agree (SA)**, 4 **Agree (A)**, 3 **Neutral (N)**, 2 **Disagree (D)**, and 1 **Strongly disagree (SD)**.

Theme/item	Scale				
	1 SD	2 D	3 N	4 A	5 SA
Using this version, I feel:					
Better course outcomes are achieved	1	2	3	4	5
Course content is better understood	1	2	3	4	5
Course content is organized better	1	2	3	4	5
I am comfortable learning the course content.	1	2	3	4	5
Course content is more appealing to the eye.	1	2	3	4	5
Academic achievement has increased.	1	2	3	4	5
Reading the content is more enjoyable.	1	2	3	4	5
Learning technology terms is quicker.	1	2	3	4	5
It is easier to read the content.	1	2	3	4	5
Learning the content is smoother.	1	2	3	4	5
Learning the content is more meaningful.	1	2	3	4	5
Content is suitable for special needs students.	1	2	3	4	5
It is easier to bookmark, highlight, and annotate text	1	2	3	4	5

Chapters and sections are nicely organized.	1	2	3	4	5
There is good contrast and use of colors focusing on key points	1	2	3	4	5
It is easier to use and navigate through the content.	1	2	3	4	5
Design is more suitable to different learners' needs.	1	2	3	4	5
Design can match students' various interests and needs.	1	2	3	4	5
Multimedia elements are clearer.	1	2	3	4	5
Design is more suitable to various learning styles.	1	2	3	4	5
Interaction with the content has increased.	1	2	3	4	5
Assessment activities and tests are more engaging.	1	2	3	4	5
Engagement in learning is higher.	1	2	3	4	5
This version can develop students' higher-order thinking skills.	1	2	3	4	5
This version can promote creativity.	1	2	3	4	5
Students' learning styles are better accommodated	1	2	3	4	5
My attitude is more positive	1	2	3	4	5
I feel more comfortable using this version	1	2	3	4	5
Motivation to learn is higher.	1	2	3	4	5
I recommend using this version in all courses.	1	2	3	4	5
I wish all courses would use this version.	1	2	3	4	5
I prefer to take courses that use this version.	1	2	3	4	5
This version is more desirable	1	2	3	4	5
This version is cheaper	1	2	3	4	5
This version boosts positive attitudes towards learning	1	2	3	4	5
I would recommend others to use this version.	1	2	3	4	5
This version does not wear out compared to other versions.	1	2	3	4	5
This version made my learning easier.	1	2	3	4	5

What advantages do you believe e-books have compared to hard copy?
-
-
-
-
-
-
-

What disadvantages do you believe e-books have compared to hard copy?
-
-
-
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-
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-

4. Qualitative research needs to be conducted using classroom observations and interviews.

Appendix 1 The materials used in the study (I.V. and N.V)

Owing to the large volume of the e-books, they are not attached to this manuscript. However, they are available upon request.

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