

Effectiveness of E-Book in Improving Academic Performance and Attitudes toward Mathematic

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Abstract:

The aim of the study was to determine whether use of an e-book would lead to improvement in academic performance and more positive attitudes towards learning mathematics. Thus, an experiment was conducted with 56 Seventh Grade students from two middle schools in Abha, Saudi Arabia. The students were randomly assigned into either the traditional book condition (i.e., the control group) or the e-book condition (i.e., the experimental group). Improvement in academic performance from pretest to posttest differed significantly across the two conditions, with students in the e-book condition improving more than those in the traditional book condition. Further, students in the e-book condition expressed significantly more positive attitudes towards learning mathematics using an e-book after the study. Based on these results, it was recommended that technological advancement may promote learning via more positive attitudes toward mathematics.

Keywords: E-Book, Academic Performance, Attitudes, Mathematics.

Introduction:

In the era of digital advancements, numerous developments and innovations have completely transformed the lives of human beings. Of these technological innovations, one particularly includes the digitalization of the book which is now more commonly known as the e-book or digital book, or eBook. An electronic book is defined as an image and text-based publication which is available in the digital format and readable through the use of the computer or digital device (Suarez & Woudhuysen, 2013). The popularity of digital books is rising due to easy accessibility and the integration of Internet services and other e-book reading tools like Google Play Books (Dado et al., 2016). Also, e-book offers distinctive features such as full availability and easy accessibility, word or phrase search options, bookmark, word highlight, change in the font size, as well as the use of different multimedia effects like animations, oral reading, sound, and music effects which improves the preference over traditional books specifically within the young generation (Zinn & Langdown, 2011). Though the acceptance of the traditional books is still prevalent, e-books are being acknowledged for offering a pleasant reading experience which is more enjoyable and easier.

E-books are slowly gaining the pace to be incorporated as a useful tool for improving innovative learning. It has been asserted by Wong, Liong, Lin, Lower, and Lam (2011) that e-books not only serve as a tool of self-learning and leisure reading but are also effective in improving the learning and teaching facility. This is the reason that e-books are gaining high acceptance within the academic world. Furthermore, as the young generation is growing up around the new technology, their behaviour and expectations highly revolve around the utilisation of the digital media. Despite the fact that the effectiveness of the

Information and Communications Technology (ICT) in creating, engaging, and personalising the learning experiences is still nascent and a real challenge for the educators and researchers, the high-resolution colour displays, flexibility, and easy accessibility is mainly used as an adjunct to improve the personalised learning (Simonson, Smaldino, & Zvacek, 2014). Nevertheless, it is still early to adapt and assess the effectiveness of the e-books in improving the academic performance and attitude towards education.

The study conducted by Coyle (2008) highlighted that the e-book industry is primarily aimed at digitalising the printed work instead of focusing on new technologies that support the learning and improving academic performance. As a result, many of the researchers are aimed at improving the integration of the e-books in academic learning. However, the outcomes gained through a plethora of research studies indicate that both the students and the teachers are of the opinion that the e-books are not the substitute of the printed books (Berg, Hoffmann, & Dawson, 2010; Woody, Daniel, & Baker, 2010; Pattuelli & Rabina, 2010). Rather, e-books are used along with the books for offering a constructive user experience (Lee, Lee, & Jeong, 2018). Textbooks offer a standardised material both to the students and the teachers thereby ensuring the alignment of the course materials with the curriculum while supporting the pedagogical approaches and offering a focal point for the development of the instructional activities. In this regard, e-books serve as a supportive mechanism in improving academic learning as it is equipped with the technology-based education system (Orey, Jones, & Branch, 2012). E-books include a wide array of multimedia tools, innovative learning management systems, and a wide range of assessment questions with hyperlinks to other external resources which facilitate in fostering an interactive,

collaborative, and a self-directed learning environment which in turn improves the quality of education.

Much of the previous related literature has focused on undergraduate students with very few studies investigating the use of e-books within the elementary and secondary school students (Korat & Shamir, 2008; Korat & Shamir, 2007; Bolyard & Moyer-Packenham, 2006). Also, there is scarcity in the literature to investigate the impact and effectiveness of the e-book on academic learning. While only a handful of studies have focused on the impact of e-books among the students in relation to other subjects, there are hardly any studies highlighting the improvements in academic learning and performance towards mathematics. Moreover, no particular study to date has been conducted to investigate the effectiveness of e-books in academic learning within the middle school of Abha, Saudi Arabia. Taking into account all of the relevant research gaps, this study was aimed to pinpoint the trend of the e-book and its academic importance as a tool to improve mathematics among the 7th graders.

The purpose of this study was to investigate the effectiveness of the e-book in improving the academic performance and attitude toward mathematics for the 7th-grade students in Abha city, Southern of Saudi Arabia. In line with this, the research questions for this study included:

1. Would there be a significant difference in the academic performance of students using the traditional book and the e-book?
2. Would the attitudes of students towards mathematics change before and after using the e-book?

Literature Review:

Digital Textbook and Learning Outcomes The influence of the e-books on the learning outcomes of the students is assessed in

light of the educational theory that helps in assessing the mechanism through which digital books enhance academic learning. According to Lee, Lee, and Jeong (2018), learning encompasses the transmission of information from a short-term to long-term working memory. This notion is supported by the Mayer's cognitive theory of multimedia learning (CTML) which focuses on the concept that learners make attempts for building meaningful connections between the pictures and the words which promote in deeper understanding and learning as opposed to learning gained from pictures or words alone (Sorden, 2012; Wang & Shen, 2012). Richard Mayer (1999) along with other potential researchers argued that integration of multimedia helps in supporting the learning as it aligns with the normal learning capability of the brain (Anthony Jr, 2008). Mayer asserted that people are more prone to develop deep learning through a collaboration of the images and text that helps in building mental representation. The principles of the CTML encourage the learner to develop a coherent mental image from the available material. This transforms the learners to become active participant while constructing new information.

E-book supports cognitive learning which is linked to perceiving and knowing that facilitates in a better understanding of the complicated subjects like philosophy, mathematics, linguistics, and biology. Mayer's cognitive theory is effective since it promotes that learning improves when supported by multiple channels rather than a single channel (Ludvigsen, Lund, Rasmussen, & Säljö, 2010; Roskos, Brueck, & Widman, 2009; Clark, & Mayer, 2016). Since the digital books are inclusive of widespread multimedia contexts like the audio and video clips in addition to interactive quizzes and images thereby facilitating prompt learning of the students. Moreover, e-books have also been linked to improving the non-linear learning. Non-linear learning is defined as the creation of an atmosphere where the

students are offered with rich information with the freedom to explore multiple contexts which promotes in passive learning following a pre-defined linear learning pathway (Kedem, Tyree, Sha, Lanckriet, & Weinberger, 2012). Therefore, non-linear learning facilitates the improvement of the learning capabilities of the student while connecting the prior knowledge with different styles of learning.

Azevedo (2005) was of the opinion that e-books encouraged the self-directed learning as the students are able to make active learning decisions regarding the content that they need to study, the time they need to spend on building the concepts, and analyse whether they comprehend the material. In this regard, e-books help in the creation of highly engaging and collaborative learning which improves the learning skills and academic performance of the students. Different researches calculated the academic performance of the students through assessing the examination grades (Kang, Wang, & Lin, 2009; Stiggins & Chappuis, 2012). In addition to the grades, external parameters of learning were also taken into consideration. These included the individual capability of the students to learn and decipher the meaning, cognitive ability, and psychomotor domains. Henceforth, in comparison to the traditional printed textbooks, e-books facilitate in the academic improvement, cognitive development, and learning skills of the children.

E-Books and Academic Performance Different studies have critically analysed the e-book adoption and integration within the academic settings to assess the performance of the students. Peng, Ratan, and Khan (2015) compared the printed books with the e-books in an attempt to answer two broad questions: how e-books improve the learning effectiveness and how e-books are perceived by the users in comparison to the traditional books. It was analysed that although many of the digital natives have incorporated the technology, there are certain challenges with the

successful integration of the e-books within the educational context. Despite the fact that the adoption and consumption of the e-book are increasing tremendously throughout the world, e-books are more commonly used for leisure purposes. Also, there is a strong preference for college-going students for printed books (Shepperd, Grace, & Koch, 2008; Woody, Daniel, & Baker, 2010). The rationale to preference over the traditional book is the familiarity and comfort since students are mostly accustomed to studying on the desk and a chair and digital book require either an individualised computer or digital device which is not always present within the school and library setting.

While assessing the effectiveness of the e-book, research indicated that students who were taught using the e-books had a higher level of perceived effective learning as well as the psychomotor learning development as compared to students who were taught with the printed books (Shamir & Shlafer, 2011). In addition, e-books had unique affordances which include the engagement and interaction with the relevant course materials. Despite the fact that e-books solely offer reading and viewing options, yet it helps in the development of engaging behaviour in relation to the text searching, commenting, and highlighting. Media engagement is linked to passive as well as an active form of engagement (Murray & Pérez, 2011). Passive engagement is linked to paying attention to the underlying message within the mediated setting. On the other hand, active engagement is one step ahead of participation that directly improves learning and cognitive development (Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2014). In the context of e-book, active engagement is linked to asking questions, highlighting, notes, and annotations. Highlighting the context improves the learning efficiency by decreasing the time need to review the entire context.

Research on 600 students studying information management system deduced that use of the electronic resources and e-books has a meaningful and direct influence on the academic progress of students (Biranvand & Khasseh, 2014). Another research conducted by Sen (2005) eloquently analysed the impacts of the e-book and use of electronic resources on the academic performance of students. Research findings indicated that e-books effectively improved the computer skills of the students with a positive and meaningful impact on the perceived usefulness. Furthermore, the study exploring the interaction of the students with the e-book determined that e-books were more successful in developing a complete understanding of the students with the material (Maynard & McKnight, 2001). On the other hand, no prominent improvements were notified in the speed of studying the provided material between the students using e-books and the students reading from the printed textbooks. Collectively, the results directed that e-book improved the ability of students with a positive impact on behavioural intention.

Al-Astal and Zaydah (2015) conducted a pre-post-test design to assess the effectiveness of the e-book on improving the mathematical thinking capability along with the development of the mathematical concepts in the 5th grader's male students. The statistical analysis indicated no differences in the improvements of the mathematical thinking ability of young children. However, this study offered countless opportunities to find different innovative methods to interact with the children to improve class participation and engagement. Children were better able to understand the course content which effectively led to building strong teacher-student relationships. In addition, many studies have proven the effectiveness of the e-book in improving the learning process. The study conducted by Amari and Shabl (2012) accentuated that e-book adoption enhanced the

achievements of the first graders in terms of improving academic performance.

Similarly, the research conducted by Abdul Karim (2011) confirmed the increased effectiveness of the individualised self-learning which is simulated by the use of e-book that led to improvements in the creative thinking of the second-grade students. Furthermore, Alzaq (2008) determined the efficiency of the diversity of the e-book interface in terms of improvements within the academic achievement as well as the skill performance within the master level students and their attitude towards learning. Mubarez (2008) also analysed the e-book effectiveness in improving the developmental skills of kindergarten students. Lastly, the study performed by Chau (2008) positively supported the impacts of e-books on the educational growth of children. This summarises that e-book has the tendency to improve the learning and attitude of children in academia.

E-Book vs. Traditional Book:

Different researches made a comparison between the traditional printed books and the e-books for substituting the traditional books with the e-books within the academic settings. It was argued by Berg et al. (2010) that the currently available e-books were not designed to offer a similar level of usability and convenience due to a lack of anecdotal evidence. The research of Berg et al. (2010) was aimed to compare the printed books with the e-books among the undergraduate students based on the notion that they were reluctant users of the digital technology and electronic resources. However, the results indicated that the undergraduate students were not intuitively equipped to navigate the e-books which reduced the efficiency and academic performance. The study also offered suggestions to the researchers in taking into account the experiences of the students

with the printed textbook to reduce the inefficiency of the e-books.

In a similar manner, Woody et al. (2010) and Shepperd, Grace, and Koch (2008) found no difference in the improvement of the student's learning and academic performance despite the fact that e-books were offered with easy access to the supplemental material. The results of multiple types of research also concluded that students preferred traditional printed books (Korat et al., 2010; Segal-Drori et al., 2010). Therefore, a positive attitude is needed to integrate e-books within the education sector as the future of e-book is still in the developmental stages. Nonetheless, a multitude of research has indicated the improvements in the reading comprehensions amongst the young children due to added visual aids and audio representations. On this standpoint, it has been assumed that e-book has a number of potential advantages in terms of adaptive instruction and supporting the reading skills of the children. Nevertheless, the current design and pattern of the e-books are not equipped to be incorporated within the educational sector as the core mode of learning. However, with many of the easy-to-use functions that are embedded in the e-book, there is a possibility to adopt e-books in the field of academia.

To sum up, the effectiveness of the e-book in improving the academic performance and learning attitude is linked to a better understanding of the concepts with the integration of cognitive thinking to promote mathematics skills. The multimedia support through the audio, video, and other similar features also offer an added advantage over the traditional books that are suited for improved learning in children.

Methodology:

The following discusses the methodology that used to test the research hypotheses, including participants and procedure, data collection, instrumentations , and data analysis.

Participants and Procedure:

Data was gathered from two middle schools in Abha, Saudi Arabia with the assistance of two mathematics teachers. A total of 56 Seventh Grade students were selected for the study. Of these, 28 (50%) were boys and 28 (50%) were girls. Within gender, students were randomly assigned to either the e-book or traditional book conditions. Specifically, students were asked to pick a folded sheet from a basket with 28 folded sheets (half of which contained the word, “e-book” and half of which contained the word, “traditional book”). Students were then assigned to one of two math teachers (who each had a bachelor’s in Math).

Three days prior to the start of the study, the math teachers and research assistant of the e-book group administered a 12-item survey to the students about their attitudes towards using the e-book for math. The math teachers and research assistant of the e-book and traditional book groups also administered a 14-item multiple choice math test. Students then attended a 45-minute math class every day for three weeks (from the last week of January to mid-February 2020). A day after the last math class, students in the e-book group answered the same 12-item survey and students in both the e-book and traditional book classes answered the same 14-item multiple choice math test.

Measures:

The following discusses the instrumentations that used to collect data, including math attitude survey and math tests.

Math attitude survey. Students in the e-book condition were asked to fill out a 12-item attitude survey (0 = disagree; 1 = neither disagree nor agree; 2 = agree) prior to and after the study.

Cronbach's alpha for the pretest survey was .68; alpha for the posttest survey was .80. Hair, Black, Babin, and Anderson (2019) noted that measures are moderately reliable if alpha is .60 or higher. Given this criterion, the attitude surveys were reliable. Four math teachers reviewed the survey for validity and agreed that it had face and content validity.

Math test. All students answered a 14-item pretest and posttest. The following topics were covered: representation with points, measures of central tendency, representation with columns, using graphical representations for forecasting, double-sided and dual-line representation, accidents and probabilities. Six math teachers reviewed the tests for validity and agreed that it had face and content validity.

Manipulation:

Students in both the traditional and e-book groups followed the same lesson plan. Efforts were made to make teaching uniform across the groups. Both teachers had similar teaching effectiveness ratings. All students used the same textbook, 7th grade Mathematics Book, 2nd semester. While students in the traditional group used a printed textbook, those in the e-book group used an e-book.

Results:

Descriptive Statistics:

A total score was computed for each of the math tests. The highest possible score was 14. Likewise, a total score was computed for each of the surveys; the survey was scored such that a higher score indicated a more positive attitude towards using an e-book to learn math. The highest possible score was 24. The findings in Table 1 show that the mean pretest math scores for students in both the traditional and e-book conditions were quite low. Mean posttest scores, however, were close to the highest possible score of 14, thus indicating that learning took

place. The mean pretest survey score was relatively low at 11.50; attitudes appeared to become more positive after the study ended.

Table 1
Means and Standard Deviations for Study Variables

Variables	N	Traditional Book		eBook	
		M	(SD)	M	(SD)
Math test					
Pretest	56	3.56	(2.11)	2.79	(2.28)
Posttest	56	11.79	(1.47)	12.07	(1.39)
Attitudes toward learning math with an eBook					
Pretest	28	--	--	11.50	(1.53)
Posttest	28	--	--	18.36	(2.66)

Academic Performance:

To determine whether use of an e-book led to an improvement in academic performance, a 2 x 2 mixed-ANOVA was conducted. The between-subjects variable was condition (i.e., traditional vs. e-book). The within-subjects variable was time of test (i.e., pretest vs. posttest). To determine whether the e-book was more effective than the traditional book, the interaction term yielded by the mixed-ANOVA procedure was evaluated at an alpha of .05.

The findings in Tables 1 and 2 reveal that students who used the e-book performed better than students who used the traditional book, $F(1, 54) = 4.05, p = .049$. As shown in Figure 1, the improvement from pretest to posttest of students who used the e-book (i.e., improvement from pretest to posttest was 9.28) was significantly greater than the improvement of students who used the traditional book (i.e., improvement from pretest to posttest was 7.90).

Table 2
Mixed-ANOVA Results for Math Performance across Time within the Traditional and E-Book Conditions (N = 56)

Source	df	MS	F	Sig.
Between subjects	1	4.72		
Condition	54	3.53	1.34	
Error				.253
Within subjects	1	2065.73		
Time	1	13.58	615.63	.000
Condition x time	54	3.36	4.05	.049
Error				

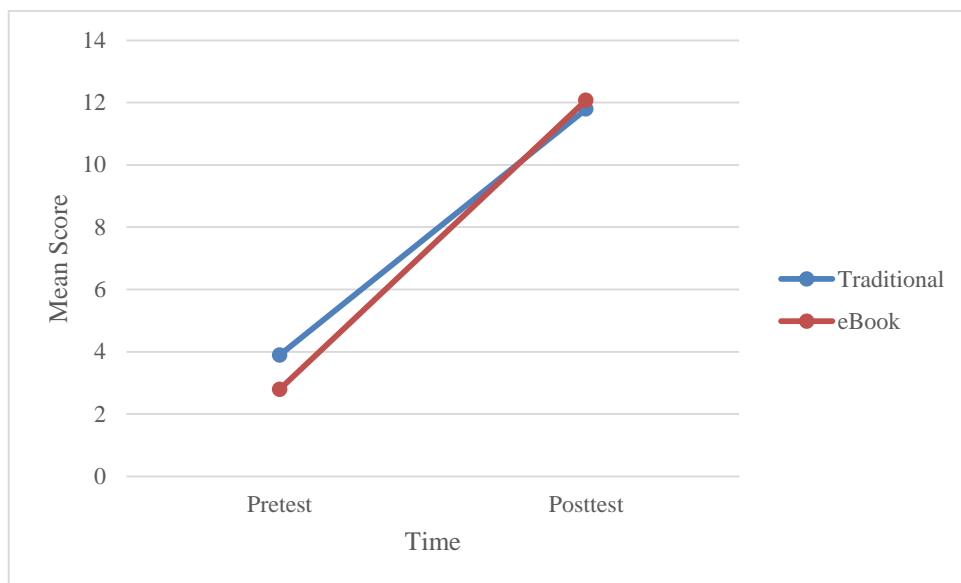


Figure 1. Mean math score from pretest to posttest for students in the traditional and e-book classes.

Attitudes toward Using the E-Book to Learn Math:

A paired t-test procedure was conducted to determine whether attitudes towards using an e-book to learn math changed from pretest to posttest. Given that improvement was expected, alpha was specified using a two-tailed value of .05. The results indicate

that attitudes towards using an e-book did significantly become more positive from pretest to posttest, $t(27) = -11.32$, $p < .001$.

Discussion:

This study documented that students who used an e-book to learn math improved in their performance more than students who used a traditional textbook to learn math. In addition, after students had a chance to use the e-book, their attitudes towards using an e-book to learn math became significantly more positive.

Interpretation of Findings:

Al-Astal and Zaydah (2015) analysed the impact of the e-book in developing and improving the mathematical skills and cognitive ability among the 5th graders' male students in Gaza. In accordance with the current study, the research by Al-Astal and Zaydah also made use of the pre-post-test design to analyse the e-book effectiveness in developing mathematics skills. The results of the study indicated the superiority of the experimental group as compared to the control group in terms of developing mathematical thinking skills and acquisition of prompt mathematical concepts. The positive outcomes were not coincidental and paved the way that e-books hold the opportunity in identifying new methods to promote engagement and interaction among the students to improve their mathematics skills. It was analysed by Pledger (2010) that e-book facilitated the students to listen to the text, take notes, change the font size, and the highlighting the text that helped in the better understanding of the book contents.

Another research study conducted by Kissinger (2011) discussed the impacts of e-books in improving mathematics learning efficacy. It was identified using e-books improved the student engagement as compared to reading from the traditional books. E-book effectiveness in terms of improving mathematics,

however, was argued by the research conducted by Ryan and Deci (2000) in relation to self-efficacy and self-determination theory. Self-determination theory integrates the use of the intrinsic and extrinsic motivation that relies on the psychological factors. In this regard, Ryan and Deci argued that the mathematical learning in the light of the self-determination theory, competence, and autonomy are the intrinsic motivating factors and a student could only improve mathematics if he or she feeds like learning and solving mathematical formulas and equations based on personal will. Therefore, learning source and method is an indirect variable that does not induce a direct effect on academic performance and learning attitude.

Carnahan (2014) also assessed that impacts of the e-books and online mathematical games to examine the elementary school achievement in 3rd-grade students. It was assessed that learning from the e-books improved the student engagement in 22 3rd grade students who were taught with the e-books. It was also analysed that improvements in the academic performance and learning attitude towards mathematics in young children was also motivated by the teacher preparedness to teach and efficiently utilise the e-book. Also, the quality of the e-book used in the classroom also affected the learning attitude and academic achievement of the students towards mathematics. E-books with math games and interactive quizzes improved the learning ability and attitude of the students. Furthermore, the study also assessed that creation of a collaborative as well as a competitive environment with the introduction of the e-books also improves the student achievement in improving the mathematical skills. The research offered critical insight into how the integration of digital technology, in general, has improved the learning and cognitive abilities of the students while improving their problem-solving skills.

An experimental study was conducted by Ke (2008) that clearly depicted the comparison between online learning and traditional learning methodologies in 2nd-grade students to assess academic performance. The total student population was divided into four populations which included the control, individualistic, competitive, and cooperative. A total of 158 students were assessed on mathematical skills twice a week for 40 minutes. The results were assessed after 4 weeks and it was determined that online learning and teaching from the e-books positively improved the enjoyment, class participation, motivation, and self-confidence of the students towards mathematics. Moreover, it was analysed that a collaborative style of learning outperformed the academic achievement of the students in terms of facilitating a positive learning attitude towards mathematics. In addition to determining the effectiveness of e-book and its positive impacts on the student mathematics skills, the outcomes of this research also determined that a collaborative learning environment improves the cognitive and decision-making skills of the students.

A similar study by Plass et al., (2013) analysed the different modes of play in improving the mathematics relation education of the students with the inclusion of the e-books containing math quizzes and games. The aim of the study conducted by Plass et al. (2013) was to analyse the arithmetic fluency amongst the 5th-7th-grade students. All the students were placed in three groups and were given minimal instructions on how to solve the math quizzes. The teams were assessed on the best scores within a 15-minute time period. The study concluded that math problems were solved more efficiently with a better performance in the group which supported collaboration. As opposed, the group with the limited math scores included the one where performance and math problems were solved on an individual basis. The control group who were taught with the traditional math books

with no quiz and games had the lowest score in terms of arithmetic fluency. This study determines that online engagement helps in improving cognitive development and learning ability to solve math problems in an efficient manner.

Uygarer and Uzunboylu (2017) investigated the effectiveness of the digital teaching book in comparison to the conventional printed books in distance learning education program. Twenty participants were selected from a distance education program and were assessed on the basis of their mathematics, science, philosophy, and other core academic skills. Using a mixed research method and purposeful sampling methods, it was analysed that the students enhanced their educational skills with the use of the electronic sources as compared to the students who were educated with the non-digital materials. The effectiveness of the e-books was supported with the motivation of the students due to the fact that e-books offered better engagement in the lessons while offering links to other educational programs to solve the queries in an efficient manner. E-books that are specifically designed to improve the teaching and learning of the students interlinked with multiple platforms and connections help in building the interest of the students. Permanent information and use of multimedia are other factors that help in building the student interaction and motivation that in turn improves the cognitive thinking and academic performance.

Limitations:

Limitations of the research study generally include the factors that are not under the control of the researcher. However, such shortcomings could potentially limit the research methodology as well as the analysis of the study. In the present research, the researcher made use of the experimental research study to assess the effectiveness of the e-books and the attitude towards learning mathematics in 7th-grade students as compared to traditional books. Although experimental research has been identified as the

most appropriate form of a research study to draw causal outcomes while assessing the interventions and impact of different factors which could change the research outcomes, experimental designs often lead to the creation of an artificial and ambiguous situation that does not always depict real-life outcomes (Robson, 2011). This limitation is due to the fact that experimental research is often tightly controlled which may alter the results of the experiment. In this regard, experimental research could not reflect the true indicators of the behaviours of the respondents.

Human error plays a crucial role in project reliability and validity. Since this research study was conducted on students belonging to two middle schools in Abha, Saudi Arabia, limited sample size could have influenced the outcomes of the results. Therefore, the geographical restriction was one of the primary limitations of this research study. Also, the mood, learning ability, life experiences, and quality of life of the respondents could induce bias in the research outcomes (Coughlan, Cronin, & Ryan, 2009). Irrespective of the fact that experimental research is powerful in assessing the causal inferences, this research design does not typically answer the “why” questions (Shipman, 2014). For instance, the outcomes of this experimental study indicated that e-books enhanced the learning attitude and academic performance of the students towards mathematics. However, the study didn't assess the underlying causes and variables which led to the effectiveness of the e-books or why e-books should be preferred over the traditional printed books.

Conclusion and Recommendations

To conclude, this study was based on an exploratory design by nature, in order to better comprehend the understanding and learning the attitude of students towards mathematics with the use of the e-books to improve their academic performance. Based on the data analyses and discussions highlighting the

experimental research design, the study concluded two major findings in relation to academic performance and attitude toward learning mathematics, as well as comparison between the e-books and the traditional printed books. Research agendas in this study were specifically based on the 7th-grade students learning effectiveness in two of the middle schools of Abha, Saudi Arabia, while assessing any improvements in the statistics and probability topics. It was analysed that further information and a deep understanding within this core domain, as specified in the previous literature could pave the way for future recommendations thereby offering advanced insights for the educational leaders as well as the academic policymakers to induce the e-book learning setup within the middle schools to improve the students learning.

Students used within the experimental research design augmented their academic performance and learning attitude towards mathematics with the use of e-books, through individually selected contexts and purposeful learning which improved their cognitive development and problem-solving skills (Kissinger, 2011). E-books containing math quizzes and additional information linked to external sources facilitated the students to better understand the concepts of probability and statistics in mathematics. Also, learning from e-books offered the students with social learning opportunities that were embedded with the use of the e-books. Students shared ideas, interacted, and communicated with other students to improve their learning and understanding which increased the overall academic performance. In a rapidly changing world that is more open and interlinked, the outcomes of this study impose that an engaging learning environment with the introduction of e-books with the classroom settings could help the students in becoming more authentic and contextualised learners by transcending the limitations and barriers linked to traditional classroom setups.

Learning with e-books and inclusion of technology in the classroom is a standard example of the fast-paced globalised age. The globalised educationalists and teachers need to recognise the effectiveness of electronic books to ensure the successful transition of the students into the future.

Based on the results, it is recommended to the educational learners to understand the changing mindset of the people towards the integration of technology and integrate the effects of e-books and online learning material to be easily accessible to all the students. Also, factors that influence the self-efficacy of the students with e-books should be assessed and explored to analyse the competitiveness to the emerging instructional technologies to be accepted by a wider population (Ebied & Rahman, 2015). Another important recommendation is to analyse the perceived value of the students towards the use of e-books. As demonstrated by this study, a large number of students supported the use of e-books over traditional books as it offered multiple opportunities and enhanced student engagement and creativity skills. The implications of the e-books require a better understanding and training of the educational providers to value the learning capabilities of the digital medium.

The present research indicated that students were thoughtful and keen on the use of e-books to improve their mathematics performance. Application of the e-books should be expanded to other subject areas to improve the overall learning and academic performance of the students by offering them opportunities to learn and develop a better understanding. Also, the overall outlook of the e-books should be augmented with the provision of numerous functionalities like bookmarking and searching through hyperlinks to improve the learning of the students. Research to explore and identify the metacognition impacting the behaviour and attitude of the learners is specifically recommended to identify and analyse the choices of the students

to support the e-book learning efficacy. Also, it is recommended to assess the impact of an e-book learning environment and its importance in supporting the learning and transforming the academic experiences of the students.

The final recommendation of this research is to study and develop the concept of social textbooks. The experimental outcomes of this study revealed that students overwhelmingly improved their academic performances when a collaborative and interactive learning environment was created with the inclusion of the e-books. Therefore, it is imperative to induce a change in the learning style and traditional methods adopted by the education providers to improve the cognitive learning ability of the students. Providing the schools with specialised educational gadgets at affordable prices could revolutionise the modern educational system that could support the academic performance and learning attitude of the students. Also, provision of educational gadgets and personalised devices could reduce the cost of the traditional printed textbooks once and for all. Therefore, education providers and policymakers need to seriously consider different methods to integrate the use and effectiveness of ICT with the education and training of the students. Different specialised training and development programs for the teachers and students could help in transforming the theoretical and practical insights strengthening the technical and scientific skills and knowledge of the students.

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