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Factors Influencing Students' Intention to Use E-Textbooks and Their Impact on Academic Achievement in Bilingual Environment: An Empirical Study Jordan

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Abstract: E-textbooks are becoming increasingly important in the learning and teaching environments as the globe shifts to online learning. The key topic is what elements influence students' behavioral desire to use e-textbooks, and how the whole operation affects academic achievement when using e-textbooks. This research aims to investigate the various factors that influence the behavioral intention to use an e-textbook, which in turn influences academic achievement in a bilingual academic environment. The research model was empirically validated using survey data from 625 e-textbook users from bilingual academic institutes from Jordan. Structural equation modeling (SEM) analysis was employed to test the research hypotheses by using Amos 20. To validate the results, artificial intelligence (AI) was employed via five machine learning (ML) techniques: artificial neural network (ANN), linear regression, and sequential minimal optimization algorithm for support vector machine (SMO), bagging with REFTree model, and random forest. The empirical results offer several key findings. First, the behavioral intention of using an e-textbook positively influences academic achievement. Second, attitude toward e-textbooks, subjective norms toward e-textbooks, and perceived behavior control toward e-textbooks positively influence behavioral intention toward using e-textbooks. Attitude toward using e-textbooks and perceived behavioral control both are positively influenced by independent factors. This study contributes to the literature by theorizing and empirically testing the impacts of e-textbooks on the academic achievement of university students in a bilingual environment in Jordan.

Keywords: e-textbook; academic achievement; structural equation modeling; machine learning; artificial neural network

1. Introduction

By definition, an e-textbook according to Pešut, quoting [1], "is a mix of workbook, reference book, exercise book, case book and manual of instruction based on static hyper-text or multimodal text, which meet curricula standards (pedagogic resources) or/and is an alternative learning tool, located in a digital library accessed through a personal computer or mobile digital device connected to the internet and directed from an educational platform" [2]. The e-textbooks are categorized according to certain characteristics or functions. Ref. [3] suggested the following characteristics through eight key groups: navigation features, access features, technical performance, relevance, interaction features,

presentation features, educational impact and sensitivity to diversity. Ref. [4] used functions “authentication, copyright, contents representation, related information, added information by learners, learning support and restriction of contents and platforms”. Even [2] proposed a conceptual model for an e-textbook based on the characteristics studied and suggested.

There are many advantages to e-textbooks over textbooks according to the literature. The study [5] listed advantages, such as the searchability of the textbook, the accessibility, interactivity, dynamic, cost-effectiveness, and reachability to students. Further, [6] listed advantages such as ease of storage, remote access, convenience, download capabilities, ability to send emails and add information, copy capability, and portability. While others, such as Ref. [5], listed challenges facing e-textbooks, which include content piracy from publishers and technology barriers from the readers’ perspective. In addition are eye fatigue, limited battery power, power use, and inconvenience of technical problems [7]. However, although students prefer the use of e-textbooks [1,7–12], many would rather use textbooks [6,7,13,14], and many researchers stated that students have difficulty in comprehending the lessons from e-textbooks [15–17]. To measure how much a student comprehends from e-textbooks, this research examined academic achievement. The research [11] found that whether using textbooks or e-textbooks made no difference in academic achievement. Consequently, the importance of this research stems from the influence of behavioral intention toward e-textbooks and its influence on academic achievement. In many studies, the researchers listed the advantages and challenges of e-textbooks, yet many refrained from using e-textbooks. This study will show the influencing factors of behavioral intention toward e-textbooks and their influence on academic achievement.

The objective of this research is to examine the factors influencing behavioral intention toward e-textbook use, thus influencing the academic achievement of the student in a bilingual academic environment. The research studied the factors that directly influence intermediate variables (attitude and perceived behavioral control), which in turn influence the intermediate variable behavioral intention and extend the influence on academic achievement. Specifically, the current research has the following aims:

- Examine the influence of perceived risk, perceived usefulness control, ease of use, and compatibility on attitude toward e-textbooks.
- Examine the influence of self-efficacy and facilitation conditions on perceived behavioral control toward e-textbooks.
- Examine the influence of attitude, subjective norm, and perceived behavioral control on behavioral intention toward e-textbooks.
- Examine the moderator variables’ influence on behavioral intention toward e-textbooks.
- Examine the influence of behavioral intention toward e-textbooks on academic achievement.

The motivation of this research is the following: although students prefer the use of e-textbooks [1,7–12], many would rather use textbooks [6,7,13,14], and many researchers stated that students have difficulty in comprehending the lessons from e-textbooks [15–17]. To measure how much a student comprehends from e-textbooks, this research examined academic achievement. The research [11] found that whether using textbooks or e-textbooks made no difference in academic achievement.

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The major contribution of the current research is the examination of a developed model that includes seven independent factors with three intermediate factors and six moderating factors. Hence, the research tried to have a comprehensive look at the e-textbook influencing factors; to the researchers’ knowledge, neither research was found to include all these factors within one research scope of e-textbooks, nor to examine the developed model in the bilingual context.

The following is the key findings of this research. Perceived risk is having a low influence on attitude toward e-textbooks from the students' perspective. Perceived usefulness, ease of use, and compatibility positively influence attitude toward e-textbooks. Self-efficacy and facilitation conditions positively influence perceived behavioral control toward e-textbooks. Attitude, subjective norm, and perceived behavioral control positively influence behavioral intention toward e-textbooks. Behavioral intention toward e-textbooks positively influences academic achievement. Moderator variables (age, gender, university type, and internet experience) influence behavioral intention toward e-textbooks. However, educational level and university location do not.

This research paper begins with a review of the literature that supports the model developed for this study. Following that, the model's theoretical framework is explained, along with the development of hypotheses. The survey design and methodology are then explained. Following, the data analysis is presented, including the descriptive analysis, SEM analysis, and artificial intelligence (AI) validation and prediction. Following that, a discussion of the theoretical and practical implications is offered. The limitations and future research are then discussed. Finally, the conclusion and discussion are presented.

2. Literature Review

Many studies were conducted to examine factors influencing students' perspectives toward e-textbooks. Ref. [2] attempted to explain the student behavioral intention of adopting e-textbooks using five models: theory of planned behavior (TPB), technology acceptance model (TAM), decomposed TPB model (DTPB), combined TAM and TPB model (C-TAM-TPB), and unified theory of acceptance and use of technology (UTAUT). However, the study excluded academic achievement and studied each model separately. Undergraduates' and graduates' *awareness, use, and attitudes* toward e-books were assessed by [18]. To investigate differences in the level of *awareness, use, and attitudes* toward e-books among undergraduates and graduates were based on *gender, discipline, and degree level*. Ref. [7] investigated student satisfaction with e-textbooks in higher education and found that students had a moderately positive, above-neutral attitude toward e-textbooks. The study [6] investigated the *perceived usefulness, perceived ease of use, relative advantage, compatibility* influence on *attitude (AT)* toward the use of e-textbooks, with *intention* as a mediating variable and the influence on *actual use*, while emphasizing the importance of *gender, social influence, and emotional factors*. Ref. [10] used TAM to investigate the two factors of ease of use and usefulness in measuring the student experience in an e-textbook. Ref. [11], citing [12], concluded that e-textbook ease-of-use had "positive, meaningful effects on students' attitudes toward e-textbooks and behavioral intentions to purchase e-textbooks". To evaluate system reading e-books, researchers [8] looked at four factors: system quality, information quality, service quality, and user satisfaction. Ref. [12] found that students' intentions to use an e-textbook in the future were directly related to their "perceived usefulness of e-texts" and "satisfaction with e-texts". Ref. [19] investigated the continuance intention and satisfaction to use e-textbooks among high school students in South African schools and is based on the work of ref. [9] of the expectation–confirmation Model (ECM). Ref. [9] investigated the usability, expectation, confirmation, and continuance intentions to use electronic textbooks. From the perspective of students, ref. [20] attempted to determine the extent to which e-textbooks are used at Ajman University. The study found that gender, college type, and year of study all have an impact on the level of usage.

Other studies even researched the influence of social networks on *academic performance*, such as [16,21,22]. Ref. [21] studied the influence of social networks on academic performance. Research results showed that there was a significant impact of social network sites on the students' academic performance. Additionally, ref. [22] studied the same issue of academic performance from within a cognitive loading perspective. Ref. [16] studied the adoption of mark-up tools in e-textbooks, using the innovation diffusion theory. The research found that the "bookmark feature was statistically significantly associated with cumulative GPA". On the other hand, [11] revealed that "in any of the cases analyzed,

there was no difference in student grades between e-textbook and paper textbook sections”, while studying the technology provided by the e-textbook, instructors and teachers.

In a counter view, other studies reported in [6,13–17,23]. Ref. [13] found that students would most likely adopt the paper textbook if the prices were equivalent. They also found that about 10% of students would continue to adopt the paper version even if the price was 3.5 times that of the e-textbook. The study of [14] conducted in Indonesia found that 83% of their sample study read e-books on their personal computing devices, yet 60% of the research sample still preferred the printed book format over eBook format. Additionally, Ref. [6] stated that 81.5% of their study participants preferred printed books over e-books. Although many found that students do prefer e-textbooks, others found that students face difficulties learning using e-textbooks [15,17,23], according to [16]. In fact, Ref. [17] found that participants assigned to the screen-reading study condition of an experiment had poorer metacognition than students who read a hardcopy text.

As such and to identify the research gap, although students prefer the use of e-textbooks [1,7–12], many would rather use textbooks [6,7,12–14], and many researchers stated that students have difficulties in comprehending the lessons from e-textbooks [15–17,23]. Meanwhile, ref. [11] found that whether using textbooks or e-textbooks made no difference on academic achievement. Academic performance, also known as academic achievement, was studied by [21–24]. The first two studies [21,22], examined the role of social media influence on academic performance, while [23] studied the influence of e-textbook on academic performance. In addition, Ref. [24] studied the ICT digital skills and its influence on academic performance. To measure how much a student comprehends from e-textbooks, the current research examined academic achievement. Furthermore, the study was conducted in a bilingual academic environment.

3. Theoretical Framework and Hypotheses Development

The suggested model shown in Figure 1 is based on the theory of planned behavior (TPB) developed by [25], decomposed theory of planned behavior (DTPB) by [26], and the model developed by [27]. This paper refers to more than 23 research papers that studied e-textbooks [1–29]. Further, more than five research papers investigated academic performance [18,21–24]. Hence, the model is composed of four types of variable independent, mediating, moderating and dependent variables. There are seven independent variables, namely, perceived risk (PR), perceived usefulness (PU), ease of use (EU), compatibility (CT), subject norm (SN), self-efficacy (SE), and facilitating conditions (FC). There are three mediating variables: attitude (AT), perceived behavioral control (PBC), and behavioral intention (BI). Additionally, there is the dependent variable, academic achievement (AA). The six moderating variables are age, gender, internet experience, educational level, university location, and university type. As such, 16 hypotheses were developed based on the model described above. The hypothesis development is presented next.

Indeed, SEM and CFA will verify the hypotheses and analyze the results. In addition, ML will validate the results of SEM, and predict mean square error and correlation coefficient (R^2), like the work of [30–36]. Further, since scholars suggested researchers to use the triangulation of mixed methods [37], which is a very effective tool to understand the research under exploration more in depth, the current research used structural equation modeling (SEM), confirmatory factor analysis (CFA), and machine learning (ML) methods. Ref. [37] argued that the idea behind triangulation is that one can be more confident in a result if the use of different methods or sources leads to the same results. Specifically, this research employed the method of triangulation by using multiple methods of data collection and analysis, in addition to researcher triangulation, as multiple researchers collected and/or analyzed the data.

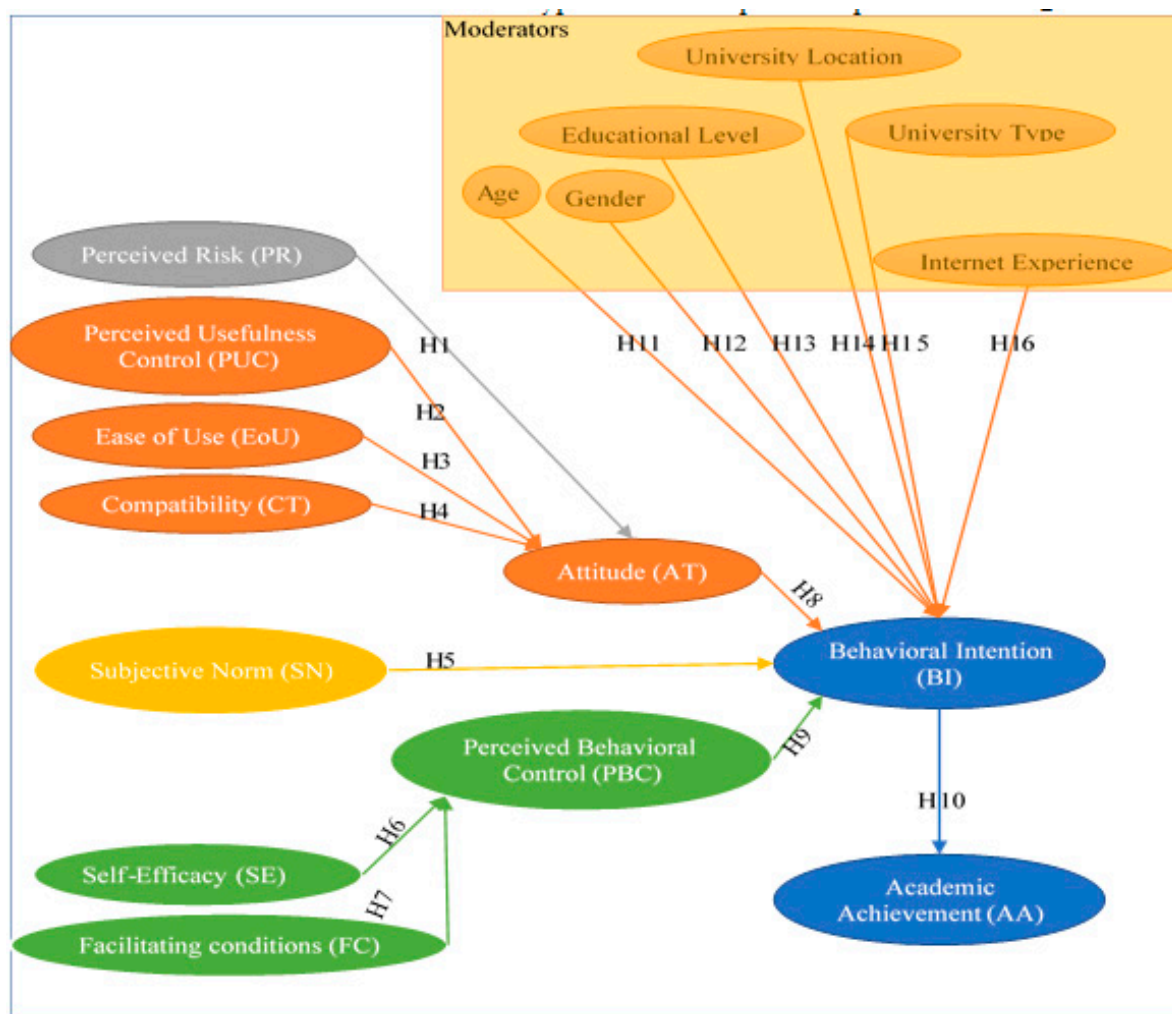


Figure 1. The suggested model adopted from [1] based on DTPB [26].

3.1. Hypotheses Development

Perceived risk (PR) influence on attitude (AT) was examined in several studies: in [38] in the realm of e-government applications; by [24,39–42], in e-banking, m-banking, and finance, respectively. Further, *PR* encompasses five dimensions: performance risk, financial risk, time risk, psychological risk, social risk, privacy risk, and overall risk as explained in [40]. Based on the previously studied research, the following hypothesis was developed.

H1. *Perceived risk (PR) has a positive effect on attitude (AT) toward using e-textbooks.*

According to [43] “key quality attributes underlying *perceived usefulness* were expectations of accuracy, security, network speed, user-friendliness, user involvement and convenience”. Additionally, Ref. [10] stated the importance of usefulness and ease of use. According to [6,27], *perceived usefulness control (PUC)* influences attitude (AT). Consequently, we hypothesized the following.

H2. *Perceived usefulness control (PUC) has a positive effect on attitude (AT) toward using e-textbooks.*

The consequence of complexity is ease of use (EU) according to [43], which influences attitude (AT) according to the same source. Ease of use (EU) is also adopted from [44] in [27], from [11] quoting [6,10,12]. Hence, the following hypothesis was developed.

H3. *Ease of use (EU) has a positive effect on Attitude (AT) toward using e-textbooks.*

As stated in [43] quoting [45], “Compatibility is the degree to which the innovation fits with the potential adopter’s existing values, previous experience and current needs”. As shown in [6,43], compatibility (CT) influences attitude (AT). Therefore, the following hypothesis was proposed.

H4. *Compatibility (CT) has a positive effect on attitude (AT) toward using e-textbooks.*

A definition by [43] is that “A subjective norm represents an individual’s normative belief concerning a particular referent, weighted by the motivation to comply with that referent”. Hence, as an adopted definition in this study according to [43], the normative belief refers to an individual’s perception of the use of e-textbooks by friends or colleagues. In [27,43], both discussed the influence of the subjective norm (SN) on behavioral intention (BI). Hence, the following hypothesis was developed.

H5. *Subjective norm (SN) has a positive effect on behavioral intention (BI) toward using e-textbooks.*

“Perceived behavioral control (PBC) reflects the resources/opportunities needed to perform a behavior, or internal/external factors that may hinder a behavior. Originally, PBC was defined as “Control beliefs reflect the perceived difficulty (or ease) with which the behavior may be affected” by [25]. Thus, it encompasses two components: (1) facilitating conditions, and (2) self-efficacy” [27]. *Facility* is composed of two factors [27]: resources and technology. Resources include time and money as facilitating factors. Technology includes software, hardware, and communications, while “self-efficacy, represents an individual’s self-confidence in his or her ability to perform a behavior” [27].

Both self-efficacy and facilitation are influencers on perceived behavioral control (PBC). A definition of self-efficacy by [27] states that self-efficacy “represents an individual’s self-confidence in his or her ability to perform a behavior”. Back in 1977, self-efficacy was discussed by [46] and was defined as self-knowledge to use an object. It was further discussed in [26,27] that self-efficacy influences PBC. Both sources [27,43] stated that “facility refers to externally based resource constraints, such as time, money and resources”, and then influences PBC. Thus, the following two hypotheses were developed.

H6. *Self-efficacy (SE) has a positive effect on perceived behavioral control (PBC) toward using e-textbooks.*

H7. *Facilitating conditions (FC) has a positive effect on perceived behavioral control (PBC) toward using e-textbooks.*

According to [27], attitude represents an individual’s positive or negative feelings about performing the target behavior. The same source suggested that attitude (AT) influences behavioral intention (BI). Consequently, we hypothesized the following.

H8. *Attitude (AT) has a positive effect on behavioral intention (BI) toward using e-textbooks.*

Perceived behavioral control (PBC), as discussed previously in [25], reflects the “resources/opportunities needed to perform a behavior”. In addition, perceived behavioral control is comprised of an individual’s past experience, anticipated obstacles, and resources [27]. Consequently, the following hypothesis is proposed.

H9. *Perceived behavioral control (PBC) has a positive effect on behavioral intention (BI) toward using e-textbooks.*

In [27], behavioral intention (BI) to use e-textbooks is influenced by three determinants: attitude (AT), subjective norms (SN) and perceived behavioral control (PBC) also shown in [43]. Attitude (AT) is further decomposed to three components: ease of use (EU), perceived usefulness (PU) and compatibility (CT), as in [43], where “Compatibility refers to the degree to which the use of e-textbooks is perceived by a college student as being consistent with his or her studies” [27]. As for subjective norms (SN), there are two factors: peer influence and superior influence. However, since the school environment refers to one group as stated by [27], both factors are merged in this study, furthering the original

model developed by [25]. The source [43] stated that “Both the TRA and the TPB assert that behavior is a direct function of behavioral intention”. Academic performance is reflected and coined with academic achievement. Academic performance was studied by [21–24]. The first two studies [21,22] examined the role of social media influence on academic performance, while [23] studied the influence of e-textbooks on academic performance. Additionally, Ref. [24] studied the ICT digital skills and its influence on academic performance. Further, according to [21], use behavior (UB) influences academic achievement (AA). Therefore, the following hypothesis was proposed:

H10. *Behavioral intention (BI) has a positive effect on academic achievement (AA).*

3.2. Hypotheses Related to Moderating Factors

In addition to the seven main factors, six moderating factors were included in the study. The moderating factors as suggested in the model are age, gender, education level, university type and location, and internet experience. The development of hypotheses on moderation factors is based on [18,47–49].

3.2.1. Age as a Moderating Factor

Age as a moderating factor is of two aspects. One may argue that older people are less accepting of modern technology, while younger generations are more accepting. On the other hand, one may argue that the older generation will be more willing to accept e-textbooks since they value such sources more. Many studies used age as a moderating factor, i.e., [49], and suggested by the UTAUT model in [27]. Still, there are many discrepancies regarding the age categorization as discussed in [49] when quoting [50–54]. The researchers of this study chose this category since it was classified by [55] as reflecting the millennial generation, which represents the future generation, and more than 25% of the Jordanian population as shown in the previous literature [56]. Hence, based on the previous, we have the following hypothesis.

H11. *Age has a significant moderating effect on student behavioral intention toward e-textbooks.*

3.2.2. Gender as a Moderating Factor

Gender is another moderating factor that may influence behavioral intention suggested in UTAUT as seen in [27]. Many studies included gender as a moderating factor [6,18,28,29,47–49,57–61]. Hence, the below hypothesis was developed.

H12. *Gender has a significant moderating effect on student behavioral intention toward e-textbooks.*

3.2.3. Education Level as a Moderating Factor

The education level of the student (whether B.Sc., Master, or Ph.D.) is suggested in this research, adopted from [18]. Therefore, the following hypothesis was developed.

H13. *Education level has a significant moderating effect on student behavioral intention toward e-textbooks.*

3.2.4. University Location as a Moderating Factor

This study is localized in Jordan. Jordan’s main provinces are north, middle, and south where universities are located. Thus, based on the previous, we have the following hypothesis.

H14. *University location has a significant moderating effect on student behavioral intention toward e-textbooks.*

3.2.5. University Type as a Moderating Factor

The university type refers to public universities and private universities. Public universities are subsidized by the government, and admittance is by national competition, while private universities are not subsidized, and admittance is based on university capacity with some rules regarding major and grade. As private universities are more expensive since they provide students with e-textbooks, the financial capabilities of the student are reflective of the university type. Consequently, the following hypothesis was proposed.

H15. *University type has a significant moderating effect on student behavioral intention toward e-textbooks.*

3.2.6. Internet Experience as a Moderating Factor

Internet experience is how much a student knows how to use the internet; it is classified by researchers as weak, good and excellent and suggested by the UTAUT model in [27] and by the study [49]. The study [49] concluded that “internet experience is important in understanding customers’ perceptions and behavior within the online environment” and “There are also interesting findings on the role of experience in the usage of new IT applications”. Hence, the following hypothesis was developed.

H16. *Internet experience has a significant moderating effect on student behavioral intention toward e-textbooks.*

4. Research Methods

This study aims to study the total effect on academic achievement (AA), using e-textbooks. The study examines perceived risk (PR), perceived usefulness control (PUC), ease of use (EU), compatibility (CT) on attitude (AT); self-efficacy (SE), facilitating conditions (FC) on perceived behavioral control (PBC); attitude (ATT), perceived behavioral control (PBC) and subjective norm (SN) on behavioral intention (BI); and behavioral intention (BI) on academic achievement (AA).

Since research on this topic was limited, the researchers, after a lengthy research development stage, suggested the research model presented in Figure 1, and in turn, developed the hypotheses above. Further, a questionnaire was developed and tested, then from a sample of convenience, the data were collected from 625 participants. The next three sections, research context, measurement items, and participants and procedure, explain in detail the survey design and methods of this research.

4.1. Research Context

As the world is shifting to online learning, e-textbooks are becoming essential in the learning and teaching environment. The main question is what factors influence the behavioral intention of students to use e-textbook, and how the whole operation is influencing *academic achievement* while using e-textbooks. In this research, this study was conducted as follows.

4.2. Measurement Items

To test the research model proposed for this study, a questionnaire survey was developed. The survey items were developed based on previous studies. There are 11 direct and intermediate variables in the model, and 6 moderating variables.

Perceived risk (PR) was measured by three items adopted from [27]; the next nine items were adopted from [4] and others as can be seen; perceived usefulness (PU) was measured by four items [27,44]; ease of use (EU) was measured by three items [27,44]; compatibility (CT) was measured by four items [26,27]; self-efficacy (SE) was measured by three items [26,27]; and facilitating conditions (FC) was measured by four items [7,27]. Subjective norm (SN) [25,27] attitude (AT) [25,27], perceived behavioral control (PBC) [26,27], and behavioral intention (BI), [25,27], were each measured by three items. Academic

achievement (AA) was measured by seven items adopted from [21], with special emphasis on items concerning the constructs AA1 and AA5. Constructs and items are reflected in detail in Appendix A.

4.3. Participants and Procedure

A web-based Google docs survey questionnaire was prepared in both Arabic and English, using a 5-point Likert scale, ranging from strongly disagree (1) to strongly agree (5). The use behavior construct was an exception due to the nature of the items; still based on the work of [62], the construct was adopted. The survey was reviewed by a panel of five academicians. Feedback was collected, and the questionnaire was rectified accordingly. Consequently, the survey was piloted on 25 e-textbook users in Jordan to test the understandability of the questions. Revisions were made to the survey.

During 24 January 2022 to 6 February 2022, the survey was conducted on 625 e-textbook students, through college professors to all universities in Jordan via email, WhatsApp groups, and Facebook academic groups, in order to ensure that the respondents were students. The respondents are reflected as indicated in Table 1; the demographic profile of the respondents for this study showed that they are males and females, the majority are between 18 years and less than 34 years (millennial generation) old, hold a bachelor's degree, are from public universities, from middle and southern provinces, and have good or excellent internet experience.

Table 1. Description of the respondents' demographic profiles.

Category	Category	Frequency	Percentage%
Gender	Male	313	50.1
	Female	312	49.9
	Total	625	100
Age (Year)	18 to less than 34	498	79.7
	34 to less than 44	59	9.3
	44 to less than 54	66	10.6
	54 to less than 64	1	0.2
	64 and over	1	0.2
	Total	625	100
Education Level	Bachelor	451	72.2
	Master	160	25.6
	PhD	14	2.2
	Total	625	100
Type of University	Public University	537	85.9
	Private University	88	14.1
	Total	625	100
Location of University	Northern Province—Jordan	103	16.5
	Middle Province—Jordan	238	38.1
	Southern Province—Jordan	284	45.4
	Total	625	100
Internet Experience	Low	15	2.4
	Good	306	49.0
	Excellent	304	48.6
	Total	625	100

In addition, as shown in Table 2, most respondents used e-textbooks heavily for studying 4 times and more weekly, for more than 6 h on average, and highly frequently as a reading habit.

Table 2. Description of the respondents' answers.

Question	Category	Frequency	Percentage%
In the last 30 days, how frequently did you use e-textbooks for studying on average per week?	1 time	41	6.6
	2 times	75	12.0
	3 times	53	8.5
	4 times	387	61.9
	5 times and more	69	11.0
	Total	625	100
In the last 30 days, what is the number of hours you have studied by e-textbook on average?	Less than 2	31	5.0
	2-less than 4	78	12.5
	4-less than 6	216	34.5
	6-less than 8	247	39.5
	8 and over	53	8.5
	Total	625	100
What is the largest value of a single study that you have ever used the e-textbook to study for?	1–20%	16	2.6
	21–40%	66	10.5
	41–60%	337	53.9
	61–80%	91	14.6
	81–100%	115	18.4
	Total	625	100
In the last 30 days, how did the e-textbook rank in terms of frequency among your reading habits?	Very low	18	2.9
	Low	37	5.8
	Moderate	241	38.6
	High	278	44.5
	Very high	51	8.2
	Total	625	100

5. Data Analysis and Results

This section includes descriptive analysis, SEM analysis, moderation effects, and artificial intelligence validation and prediction.

5.1. Descriptive Analysis

To describe the responses and thus the attitude of the respondents toward each question that they were asked in the survey, the mean and the standard deviation were estimated. While the mean shows the central tendency of the data, the standard deviation measures the dispersion which offers an index of the spread or variability in the data, [63,64]. In other words, a small standard deviation for a set of values reveals that these values are clustered closely about the mean or located close to it; a large standard deviation indicates the opposite. The level of each item was determined by the following formula: (highest point in Likert scale—lowest point in Likert scale)/the number of the levels used = $(5 - 1)/5 = 0.80$, where 1–1.80 reflected by “very low”, 1.81–2.60 reflected by “low”, 2.61–3.40 reflected by “moderate”, 3.41–4.20 reflected by “high”, and 4.21–5 reflected by “very high”. Then the items were ordered based on their means. Tables 3 and 4 show the results.

As presented in Table 3, data analysis results show that most research variables are applied to high levels, whereas the respondent's attribute of self-efficacy (SE), ease of use (EU) and attitude (AT) do exist very highly. Additionally, the respondent's perceived risk is applied to a moderate level. Table 4 demonstrates the mean, standard deviation, level, and order scores for items to each variable. Reflecting on the respondents' answers, the following conclusions can be drawn: The respondents view the use of e-textbooks as low risk. Further, from examining PU results, the respondents found the e-textbook to be useful in studies. The ease-of-use item EU2, the respondents answered that e-textbook does not require a lot of mental effort. In addition, pertaining to *compatibility*, the respondents stated that the e-textbook fits with the way that they study. The subjective norm of peer pressure the respondents indicated that classmates are very supportive of using e-textbooks.

Regarding self-efficacy, the respondents indicated their ability to use e-textbooks without others' help; further, they have a person or group available for assistance. The respondents' attitude is liking the idea of using e-textbooks. Again, the respondents indicated that the use of e-textbook is within their control. The respondents' behavioral intention toward e-textbook use is very high, and they believe that the e-textbook has a positive impact on their academic achievement.

Table 3. Overall mean and standard deviation of the study's variables.

Type of Variable	Variables	Mean	Standard Deviation	Level	Order
Independent Variables	Perceived Risk (PR)	2.61	0.98287	Moderate	7
	Perceived Usefulness (PU)	4.01	1.25138	High	6
	Ease of Use (EU)	4.26	0.75732	Very High	2
	Compatibility (CT)	4.19	0.81305	High	3
	Subject Norm (SN)	4.17	0.85778	High	4
	Self-Efficacy (SE)	4.54	0.71966	Very High	1
	Facilitating Conditions (FC)	4.15	0.77246	High	5
Mediating Variables	Attitude (AT)	4.26	0.82445	Very High	1
	Perceived Behavioral Control (PBC)	4.16	0.57520	High	3
	Behavioral Intention (BI)	4.18	0.78058	High	2
Dependent Variable	Academic Achievement (AA)	4.13	0.71272	High	-

5.2. SEM Analysis

SEM analysis was employed to test the research hypotheses. First, confirmatory factor analysis (CFA) was conducted to check the properties of the instrument items. Next, structural equation modeling (SEM) using Amos 20 was performed to test the study hypotheses.

5.2.1. Measurement Model

Confirmatory factor analysis (CFA) was used to validate the instrument items' attributes. Indeed, the measurement model specifies how latent variables or hypothetical constructions are evaluated in terms of observed variables, as well as the validity and reliability of observed variable responses for latent variables [65–68]. Table 5 shows the factor loadings, Cronbach alpha, composite reliability, and average variance extracted (AVE) for the variables. All of the indicators of the factor loadings exceeded 0.50, except one item (FC4 = 0.325) which was eliminated to obtain a better fitting measurement model, thus constituting evidence of convergent validity [65,69]. Indeed, while the measurement reached convergent validity at the item level because all of the factor loadings went above

0.50, all of the composite reliability values exceeded 0.60, demonstrating a high level of internal consistency for the latent variables. In addition, since each value of AVE exceeded 0.50 [65,70], the convergent validity was proved.

Table 4. Mean and standard deviation of the study's variables.

Perceived Risk (PR)	Mean	SD	Level	Order
PR1	2.61	1.026	Moderate	2
PR2	2.69	1.045	Moderate	1
PR3	2.52	1.086	Low	3
Perceived Usefulness (PU)	Mean	SD	Level	Order
PU1	3.87	1.253	High	3
PU2	4.13	1.356	High	2
PU3	3.85	1.234	High	4
PU4	4.20	1.334	High	1
Ease of Use (EU)	Mean	SD	Level	Order
EU1	4.24	0.787	Very High	3
EU2	4.30	0.989	Very High	1
EU3	4.25	0.776	Very High	2
Compatibility (CT)	Mean	SD	Level	Order
CT1	4.36	0.950	Very High	1
CT2	4.11	0.902	High	4
CT3	4.13	0.813	High	3
CT4	4.17	0.862	High	2
Subject Norm (SN)	Mean	SD	Level	Order
SN1	4.38	0.868	Very High	1
SN2	4.09	1.054	High	2
SN3	4.03	0.922	High	3
Self-Efficacy (SE)	Mean	SD	Level	Order
SE1	4.46	0.938	Very High	3
SE2	4.52	0.766	Very High	2
SE3	4.67	0.699	Very high	1
Facilitating Conditions (FC)	Mean	SD	Level	Order
FC1	4.08	0.974	High	4
FC2	4.13	0.977	High	3
FC3	4.20	0.846	High	2
FC4	4.23	0.940	Very High	1
Attitude (AT)	Mean	SD	Level	Order
AT1	4.17	0.842	High	3
AT2	4.42	0.920	Very High	1
AT3	4.19	0.895	High	2
Perceived Behavioral Control (PBC)	Mean	SD	Level	Order
PBC1	4.05	0.632	High	3
PBC2	4.32	0.736	Very High	1
PBC3	4.12	0.643	High	2
Behavioral Intention (BI)	Mean	SD	Level	Order
BI1	3.93	0.706	High	3
BI2	4.28	0.920	Very High	2
BI3	4.32	0.879	Very High	1
Academic Achievement (AA)	Mean	SD	Level	Order
AA1	4.05	0.695	High	6
AA2	4.25	0.920	Very High	1
AA3	4.24	0.863	Very High	2
AA4	4.15	0.877	High	5
AA5	3.94	0.686	High	7
AA6	4.20	0.819	High	3
AA7	4.16	0.829	High	4

Table 5. Properties of the final measurement model.

Constructs and Indicators	Factor Loadings	Std. Error	Square Multiple Correlation	Error Variance	Cronbach Alpha	Composite Reliability *	AVE **
Perceived Risk (PR)					0.926	0.92	0.93
PR1	0.899	***	0.808	0.202			
PR2	0.884	0.031	0.781	0.238			
PR3	0.914	0.032	0.835	0.194			
Perceived Usefulness (PU)					0.976	0.96	0.97
PU1	0.939	***	0.882	0.185			
PU2	0.965	0.021	0.932	0.126			
PU3	0.947	0.020	0.897	0.157			
PU4	0.967	0.020	0.934	0.116			
Ease of Use (EU)					0.860	0.88	0.73
EU1	0.926	***	0.858	0.188			
EU2	0.724	0.043	0.524	0.465			
EU3	0.878	0.028	0.770	0.138			
Compatibility (CT)					0.940	0.95	0.96
CT1	0.830	***	0.689	0.280			
CT2	0.918	0.034	0.843	0.128			
CT3	0.905	0.031	0.819	0.120			
CT4	0.934	0.032	0.872	0.095			
Subject Norm (SN)					0.885	0.90	0.93
SN1	0.780	***	0.609	0.294			
SN2	0.880	0.056	0.774	0.250			
SN3	0.922	0.048	0.851	0.127			
Self-Efficacy (SE)					0.871	0.91	0.94
SE1	0.893	***	0.798	0.177			
SE2	0.801	0.028	0.641	0.210			
SE3	0.804	0.025	0.646	0.173			
Facilitating Conditions (FC)					0.844	0.94	0.82
FC1	0.921	***	0.848	0.144			
FC2	0.948	0.024	0.899	0.097			
FC3	0.886	0.023	0.785	0.153			
Attitude (AT)					0.922	0.94	0.84
AT1	0.905	***	0.818	0.128			
AT2	0.860	0.033	0.739	0.220			
AT3	0.931	0.028	0.866	0.107			
Perceived Behavioral Control (PBC)					0.818	0.91	0.93
PBC1	0.832	***	0.692	0.123			
PBC2	0.809	0.049	0.655	0.187			
PBC3	0.702	0.045	0.493	0.209			
Behavioral Intention (BI)					0.921	0.95	0.97
BI1	0.779	***	0.606	0.196			
BI2	0.953	0.057	0.909	0.077			
BI3	0.956	0.054	0.913	0.067			
Academic Achievement (AA)					0.948	0.96	0.97
AA1	0.711	***	0.505	0.239			
AA2	0.940	0.075	0.884	0.098			
AA3	0.925	0.071	0.856	0.107			
AA4	0.895	0.072	0.801	0.153			
AA5	0.746	0.056	0.557	0.208			
AA6	0.834	0.067	0.695	0.204			
AA7	0.855	0.068	0.731	0.185			

* Employing Cronnell and Larcker's [71] formula, the composite reliability calculation is expressed by the following equation: Composite Reliability = $(\sum Li)^2 / ((\sum Li)^2 + \sum Var(Ei))$, where Li is the standardized factor loadings for each indicator, and $Var(Ei)$ is the error variance associated with the individual indicator variables. ** The formula for the variance extracted is: Average Variance Extracted = $\sum Li^2 / (\sum Li^2 + \sum Var(Ei))$ where Li is the standardized factor loadings for each indicator, and $Var(Ei)$ is the error variance associated with the individual indicator variables.

In addition, as noticed from Table 6, all of the intercorrelations between pairs of constructs were less than the square root of the AVE estimates of the two constructs, providing discriminant validity [66]. Consequently, the measurement results indicate that this study had adequate levels of convergent and discriminant validity.

Table 6. Correlations of constructs.

Constructs	PR	PU	EU	CT	SN	SE	FC	AT	PBC	BI	AA
PR	0.96										
PU	0.340	0.98									
EU	0.168	0.624	0.85								
CT	0.400	0.561	0.596	0.97							
SN	0.376	0.419	0.518	0.866	0.96						
SE	0.387	0.537	0.784	0.837	0.800	0.97					
FC	0.570	0.761	0.349	0.627	0.449	0.478	0.90				
AT	0.234	0.644	0.849	0.687	0.592	0.808	0.395	0.91			
PBC	0.215	0.327	0.519	0.702	0.534	0.660	0.596	0.607	0.96		
BI	0.441	0.259	0.460	0.860	0.746	0.740	0.420	0.636	0.771	0.98	
AA	0.412	0.609	0.468	0.877	0.755	0.818	0.475	0.612	0.738	0.879	0.98

Note: Diagonal elements are square roots of the *average variance* extracted for each of the 10 constructs. Off-diagonal elements are the correlations between constructs.

To reflect the correlation on the model shown in Figure 1, the following is worth noting: PR correlation with AT is low (0.234) which may support the rejection of H1. The correlation of constructs PU, EU, CT with AT are 0.644, 0.849, 0.687, respectively. The correlation of AT, SN, and PBC are 0.636, 0.746, and 0.771, respectively. The correlation of BI and AA is 0.879. All previously mentioned are strong correlations.

5.2.2. Structural Model

Structural equation modeling (SEM) using Amos 20 was performed to test the study hypotheses. SEM allows simultaneous testing of all hypotheses, including direct and indirect effects. The results of the direct effects show that perceived usefulness, ease of use, and compatibility positively and significantly impacted attitude; thus, H2, H3, and H4 were accepted. However, perceived risk did not have influence on attitude ($\beta = 0.033$); consequently, H1 was rejected. Furthermore, self-efficacy and facilitating conditions positively and significantly affected perceived behavioral control; consequently, H6 and H7 were accepted. In addition, subject norm, attitude, and perceived behavioral control impacted positively and significantly the behavioral intention, and in turn, academic achievement; thus, H5, H8, H9, and H10 were accepted.

Moreover, the coefficient of determination (R^2) for the research endogenous variables for attitude, perceived behavioral control, behavioral intention, and academic achievement were 0.584, 0.322, 0.504 and 0.561, respectively, which indicates that the model does account for the variation of the proposed model. Table 7 below provides a summary of the tested hypotheses.

5.3. Moderation Effects

Hypotheses H11, H12, H13, H14, H15 and H16 argued that there is a significant difference in the respondent behavioral Intention due to gender, age, education, university type, university location, and internet experience. Independent samples *t*-test was employed to investigate if there were any significant differences in the respondents' behavioral intention (BI) that can be attributed to gender and university type. Additionally, the ANOVA test was employed to examine if there were any significant differences in the respondents' behavioral intention (BI) that can be attributed to age, education, university location and internet experience. The results of the *t*-test, shown in Table 8, indicated that there is a significant difference in the behavioral intention that can be attributed to gender

($p \leq 0.001$, t -value = 2.859), which applies for males rather than females, which agrees with the findings of [6,28,29] and for private universities.

Table 7. Summary of proposed results for the theoretical model.

Research Proposed Paths	Coefficient Value	t-Value	p-Value	Empirical Evidence
H1: PR → AT	0.033	1.918	0.055	Not Supported
H2: PU → AT	0.115	8.457	0.000	Supported
H3: EU → AT	0.574	25.538	0.000	Supported
H4: CT → AT	0.256	12.205	0.000	Supported
H5: SN → BI	0.303	15.058	0.000	Supported
H6: SE → PBC	0.341	13.874	0.000	Supported
H7: FC → PBC	0.204	10.173	0.000	Supported
H8: AT → BI	0.227	8.680	0.000	Supported
H9: PBC → BI	0.585	18.186	0.000	Supported
H10: BI → AA	0.751	28.266	0.000	Supported

Table 8. T-test of the respondent behavioral intention attributed to gender.

Variable	Male			Female			T	df	Sig.
	N	Mean	Std. Dev.	N	Mean	Std. Dev.			
Behavioral Intention	313	4.2641	0.67556	312	4.0865	0.86535	2.859	587.513	0.004

Variable	Public University			Private University			T	df	Sig.
	N	Mean	Std. Dev.	N	Mean	Std. Dev.			
Behavioral Intention	537	4.1496	0.78819	88	4.3333	0.71653	2.197	124.131	0.03

Moreover, the results of the ANOVA test, shown in Table 9, indicated that there is a significant difference in the respondents' behavioral intention (BI) in favor of age and internet experience, whereas no differences were found for educational level and university location. This is to confirm that the statistical significance of the differences between each pair of the groups is statistically different from one another for age and internet experience, while they do not differ for educational level and university location.

5.4. Artificial Intelligence Validation and Prediction

The following presents the use of five AI methods to validate the result of this research. The first section presents and introduces the five AI methods. The second section presents the validation process.

5.4.1. Machine Learning Techniques

This study uses machine learning (ML) techniques to build a collection of ML algorithms for connecting independent variables to dependent variables. As a result, five ML classification approaches were used to achieve the target. These classification algorithms take knowledge from a dataset and provide the results in the form of models [72]. Five machine learning (ML) techniques were employed: artificial neural network (ANN) [73], linear regression [74], sequential minimal optimization approach for support vector machine (SMO) [75], bagging using the REFTree model [76], and random forest [77]. The ANN is a graph of computational nodes connected with weighted edges. To reduce the estimated error in the testing phase, the training process employs a backpropagation technique that updates the networks' weights and bias parameters based on the error values between the predicted and actual output values. The linear regression model is a polynomial function with weighted coefficients for the independent variables and a target-dependent output. The training process updates the coefficients of the linear function from the dataset through a set of operations. The SMO technique is based on the weighted vectors of the SVM model

and updates the weights of the model using the sequential minimal optimization algorithm. The bagging_REFTree model depends on a set of REFTree models that are constructed from random samples of the objects and attributes in the training set. The average value of the trees then provides the ultimate predicted value. The random forest is made up of decision tree (DT) models that each uses a random sampling of training data objects and random attribute subsets for each sub-tree. The average value of the DT trees represents the model's outcome.

Table 9. ANOVA analysis of respondent behavioral intention attributed to age, education, university location, and internet experience.

Variable		Sum of Squares	Df	Mean Square	F	Sig.
Behavioral Intention attributed to <i>age</i>	Between Groups	8.366	4	2.091	3.487	0.008
	Within Groups	371.836	620	0.6		
	Total	380.202	624			
Behavioral Intention attributed to <i>educational level</i>	Between Groups	0.361	2	0.181	0.296	0.744
	Within Groups	379.84	622	0.611		
	Total	380.202	624			
Behavioral Intention attributed to <i>university location</i>	Between Groups	1.228	2	0.614	1.008	0.366
	Within Groups	378.974	622	0.609		
	Total	380.202	624			
Behavioral Intention attributed to <i>internet experience</i>	Between Groups	28.644	2	14.322	25.339	0
	Within Groups	351.558	622	0.565		
	Total	380.202	624			

5.4.2. Results and Discussion of ML Approaches

The BI and AA variables are the main factors that are influenced by other independent variables. The BI reflects the tendency behavior of the readers to use e-textbooks as an essential resource, whereas the AA variable represents the results of using e-textbooks in achieving good academic scores. The experiment results of the ML approaches indicate how ML models can predict the target values of BI and AA from the independent variables. In other words, how well these models reduce the mean error rate between actual and predicted data determines the prediction's accuracy. We validated four ML models as shown in 1: (1) Model 1, which takes perceived risk, perceived usefulness, EU, and compatibility factors as inputs and outputs AT; (2) Model 2, which takes SE and FC as inputs and outputs perceived behavioral control; (3) Model 3, which takes attitude, subject norm, and perceived behavioral control as inputs and outputs BI; and (4) Model 4, which takes BI as input and outputs AA. Hence, Model 1 encompassed H1, H2, H3, and H4; Model 2 encompassed H6 and H7; Model 3 covered H5, H8, and H9; and Model 4 covered H10. The suggested model is shown in Figure 1.

The results of five machine learning algorithms applied to four relationship models are shown in Figure 2, where the hypothesis models are represented on the x-axis, while the R² and mean square error (MSE) values are depicted on the y-axis. The R² represents the expected variation of the dependent variable (target) because of the independent values. The MSE is a measure of the average distance between a model's evaluated and actual output values. When compared to the other ML techniques of the four hypothesis models, the random forest and Bagging_REPTree ML models produce reasonable consequences, as 38 shown in Figure 2 of the R² values to the target values. This indicates that the predictions of tree-based models are more effective in the accuracy of the target labels. The ML models

in the hypothesis of Model 2 show low R^2 and MSE values, which indicates that there is no relationship between the SE and FC as input values to the perceived behavioral control as the output target. In summary, these findings show that adopting e-textbooks as a technological resource helps students achieve academic success while maintaining a good attitude. Furthermore, Figure 3 ensures the effectiveness of the random forest and Bagging_REPTree ML models that achieve low MSE values between the target and the actual values of the model.

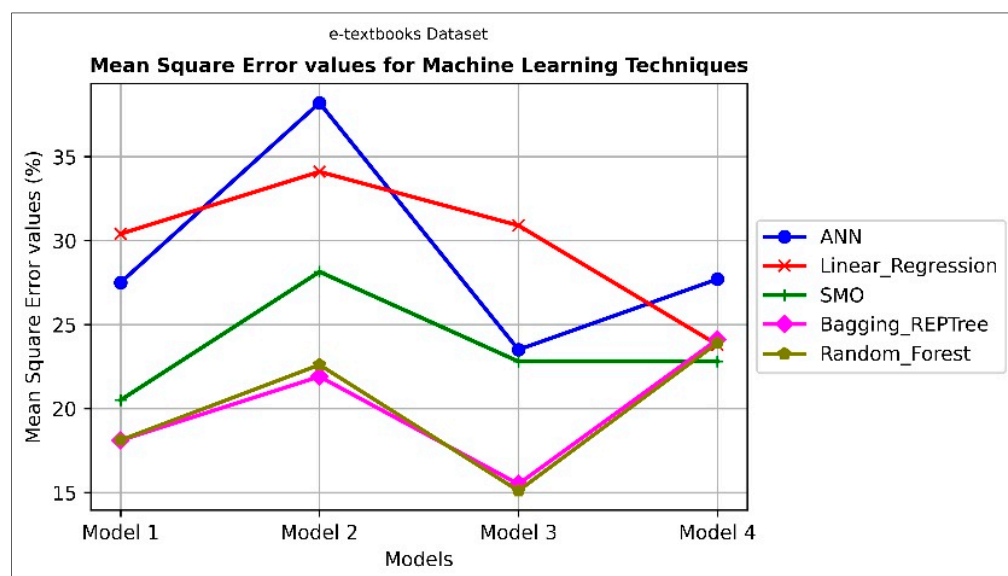


Figure 2. Mean square error values for ML.

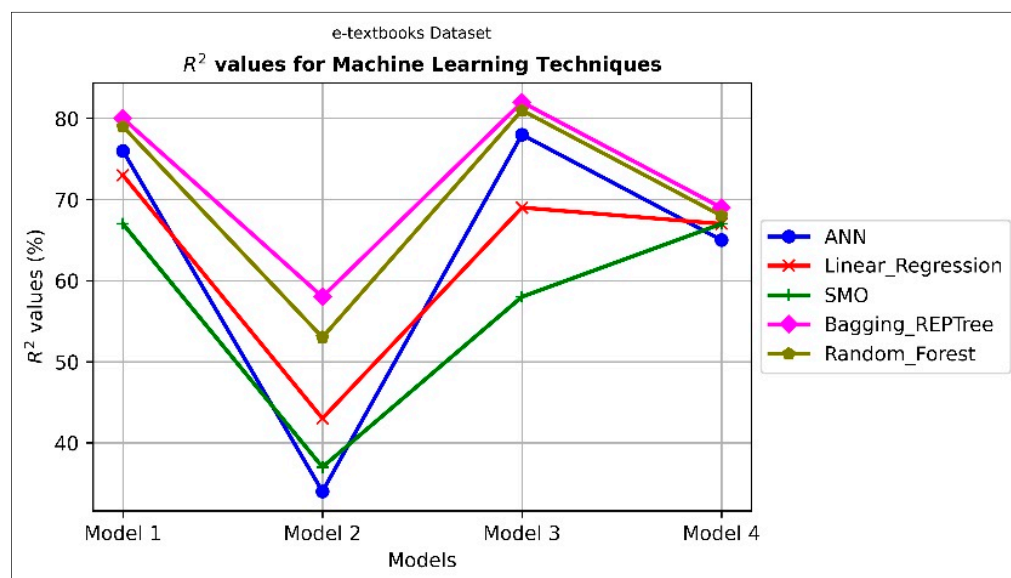


Figure 3. R^2 values for ML techniques.

6. Discussion and Conclusions

From the perspective of students, perceived risk has little influence on their attitudes toward e-textbooks. This means that students perceive e-textbooks with low risk. Hence, student trust and attitude toward using e-textbooks is positive. Such a finding agrees with [7–9]. This research found that perceived usefulness control, ease of use, and compatibility, H2, H3, and H4, all have a positive impact on attitudes toward e-textbooks. Therefore,

students consider e-textbooks to be useful, easy to use, and compatible with their tools. As such, they have a positive attitude toward e-textbooks, which agrees with [1,10–12].

This current research also found that the facilitation conditions (FC) and self-efficacy (SE) influence perceived behavioral control (PBC) toward e-textbooks, which indicate that students' self-knowledge and condition are suited toward e-textbooks. That is reflected with H6, and H7, and agrees with the finding of the sources [26,27,43] and by [46]. Attitude, subjective norm, and perceived behavioral control influence the behavioral intention toward e-textbooks in a positive way, which means that students have a positive attitude, and their subjective norms both positively influence the intention behavior toward e-textbooks, which in turn, as indicated above, influences academic achievement.

Although students prefer the use of e-textbooks [1,7–12], many would rather use textbooks [6,7,12–14]. Such a finding is reflected in this research. In fact, Table 3 shows that the dependent variable AA has a mean of 4.13 with standard deviation 0.71272 and reported high level in comparison to the other variables. As such, contradicting the research, [11] found that whether using textbooks or e-textbooks made no difference on academic achievement.

Many researchers stated that students have difficulty in comprehending the lessons from e-textbooks [15–17,23]. To measure how much a student comprehends from e-textbooks, the current research examined academic achievement. As such, this research showed that academic achievement is positively influenced by behavioral intention (BI) toward using e-textbooks. Such a finding was suggested by H10. Behavioral intention was influenced by subject norm, attitude, and perceived behavioral control and reflected in H5, H8 and H9, respectively, which are supported in this research and validated by [25,27,43].

Additionally, academic achievement is positively influenced by behavioral intentions toward e-textbooks, which implies that the behavioral intention positively influences academic achievement. Age, gender, university type, and internet experience are moderator variables that influence behavioral intention toward e-textbooks. However, the educational level and university location did not change. There is a significant difference in the behavioral intention that can be attributed to gender, which applies to males rather than females, which agrees with the findings of [6,20,28,29], and for private universities. There is a significant difference in respondents' behavioral intentions in favor of age and internet experience, whereas no differences were found for educational level and university location. Hence, the digital divide is disappearing.

As for H3, pertaining to ease of use, the finding of this research was supported by [11,12]. Intuitively, such a conclusion is sound since no one hates ease of use (EU) and the factor does influence the intermediate factor, attitude (AT). Still, in the same token, students face difficulties learning using e-textbooks [17,23,25], according to [16], but does this hold for this generation. The degree to which a college student perceives the usage of e-textbooks as being compatible with his or her studies is referred to as compatibility. Compatibility (CT) was discussed as part of H4, which was supported by this research. This finding was in line with the findings in [6,27,43,45]. A subjective norm (SN) is an individual's normative perception of a certain referent that is weighted by the motivation to adhere to that reference. SN, which is an independent factor used in H5, was supported as shown in Table 7, like the finding of [27,43].

The current research validated and verified the results of this work by using ML. Many research studies used such an idea as that of [30–36]. Hence, H1–H4 were validated for R2 and MSE using five ML methods; the results are reflected in Figures 2 and 3. Furthermore, Model 2 in Figures 2 and 3 validated the results of H6 and H7 pertaining to the influence of SE and FC on PBC. Model 3 validated the results of H5, H8, and H9 pertaining to the influence of SN, AT, and PBC on BI. Model 4 validated the results of H10, pertaining to the influence of BI on AA.

Indeed, the current research concluded that there is a positive influence in using e-textbooks on academic achievement. Hence, universities, teachers, and publishing organizations should take such conclusions into account and prepare their respective material

in such a manner. Universities should prepare faculty members for such a change and need to adapt their infrastructure as such. Publishing houses should prepare, design, and develop their published e-textbooks to accommodate the student demand. Thus, there will be a change that will engulf the teaching environment, as such, creating the need to prepare the receiving and sending environments. Infrastructure, such as hardware, software, and communications, should accommodate such change. Further, governments, and regulators should accommodate such demand from the student perspective.

Academic achievement (AA) is a principal factor to students. Hence, the demand for e-textbooks will increase in the future even more. Consequently, venues of books, such as libraries, should also accommodate such demand, including borrowing methods and a return policy, in addition to other factors that influence students to use e-textbooks, such as cost-effectiveness, navigation features, access features, technical performance, relevance, interaction features, presentation features, educational impact, searchability of the textbook, accessibility, interactivity, dynamic, and reachability. A key factor in academic achievement is a big incentive to use e-textbooks. Conducting this study sheds light about the future of education tools and the way that younger generations view the education venues. As such, educational institutes, teachers, publishers, and libraries will accommodate the demand which is coming in a different form. Hence, libraries should prepare the infrastructure and new types of loaning books with the issue of copyrights. Publishers will need to accommodate such change in their infrastructure and copyrights issues. Educational institutes need to prepare their infrastructure and plan for such change. As well, teachers will have to accommodate the change and try to deliver knowledge considering the new demand.

The study was conducted in a bilingual environment; as such, the bilingual environment must be aware of such demand and accommodate such need. In Jordan, the second language next to English is Arabic, and has attributes that may collide with English. As such, such attributes of other languages, such as French, German, Russian, and Persian, must be considered in the design and developing of e-textbooks.

6.1. Theoretical Implications

This research connected influencing factors that tie e-textbooks with academic achievement, as we know no other research that has accomplished such a goal. As such, the research paper will serve as a pedestal to researchers and practitioners as well as students and universities. Research can expand on the model used in this research. Practitioners, book publishers, book developers and designers can rely on the results extended from this research. Teachers and students can learn from the advantages and disadvantages of e-textbooks discussed in this paper. In addition, universities will take advantage of the e-textbook and reap the benefits of the e-textbook regarding saving and cost, while providing the students with an essential source of knowledge.

There is a significant difference in the respondents' behavioral intentions in favor of age, which suggests that newer generations are more accepting of and prefer e-textbooks. Hence, universities and teachers can rely on e-textbooks to provide students with much needed knowledge. As such, the current research paper will be an eye opener on the insight of the students' perspective toward behavioral intention on using e-textbooks. As can be seen in the research, younger generations are different from older generations in their intention; hence, publishers, universities and teachers can cater to such perspectives.

The advantages discussed in the beginning of the paper related to e-textbook can outweigh the challenges discussed. Hence, publishers, developers, and designers of e-textbook can rely on the results presented, especially the BI results shown in Table 5. The results suggest the direction and perspective of students now. The research paper tied the influencing factors of using e-textbooks with academic achievements. The academic achievement is a huge factor that incites students and a major factor reflecting the student comprehension ability. Further, such motivation gives an insight about the student perspective.

6.2. Practical Implications

Not all e-textbooks are equal. E-textbooks have attributes and design forms. This can be seen in studies such as [8,14,16,20], where they all looked for how to invite students to use e-textbooks and reap their advantages, besides providing the right attributes and standards of e-textbooks. This study was conducted in Jordan, where teaching is bilingual (Arabic and English); hence, such a study can be expanded to include both languages' perspectives. Further, this study gives an insight to the Arabic speaking population and their perspective on e-textbooks. As such, the findings can be generalized to education institutes and bilingual countries. Furthermore, Arabic is contrary to English as it directs the writing from right to left; hence, the design of Arabic e-textbooks may bear with it some technical challenges. Moreover, other languages, such as Chinese, Russian, and Turkish, can be studied with this scope and, based on the results, accommodate such a change in the demand and design to develop e-textbooks in accordance with the language specifications and attributes.

6.3. Limitations and Future Research Direction

This research was conducted during the COVID-19 pandemic, which has forced the researchers to use the questionnaires rather than conducting interviews. The definition of an e-textbook is not standardized; hence, many respondents consider a PDF file a e-textbook, while others considered the larger meaning of e-textbooks. Technical difficulties were faced when converting the questionnaire from English to Arabic, especially with the writing direction on Google documents. Additionally, translation difficulties were apparent when translating the questionnaire to convey the same question with the same meaning. In addition, the current research did not use a control group design since the respondents are dispersed among 29 universities across Jordan. This research addresses the general characteristics and definition of e-textbooks not as a specific design. Moreover, with the advancement of technology and the need of e-textbook during the COVID-19 pandemic, it is hard not to find anyone that does not use or has heard of e-textbooks within the higher education sector in Jordan. Additionally, rules, regulations and laws implied by the higher education authorities in Jordan were imposed as part of the higher education development plan. Consequently, it was hard and nearly impossible to implement the control group design. Nevertheless, we do recommend other researchers to conduct a study on students of higher education institutions, implementing the control group design by comparing the users of textbooks with e-textbook users and their impact on academic performance.

The study was conducted in Jordan in a bilingual environment; thus, the research can be extended to other bilingual cultures to compare the differences in culture. Other languages that are not Latin based should be accommodated, and further studies can be conducted. More detailed study that can concentrate on the e-textbook attributes can be conducted so as to explore further the factors influencing adopting e-textbooks and the influence of e-textbooks.

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Appendix A

Table A1. Research Constructs, Items and Sources.

Constructs	ID: Items/Measure	Original source
Demographic Information	<ul style="list-style-type: none"> Gender 1. Male. 2. Female. 	
	<ul style="list-style-type: none"> Age (years) 1: 18 to less than 34. 2: 34 to less than 44 years old. 3: 44 to less than 54 years old. 4: 54 to less than 64 years old. 5: 64 and over. 	[27,49–56]
	<ul style="list-style-type: none"> Educational Level 1: Bachelor. 2: Master. 3: PhD. 	[18]
	<ul style="list-style-type: none"> Type of University 1: Public University. 2: Private University. 	
	<ul style="list-style-type: none"> Location of University 1: Northern Province – Jordan. 2: Middle Province – Jordan. 3: Southern Province – Jordan. 	
	<ul style="list-style-type: none"> Internet Experience 1. Low. 2: Good. 3: Excellent. 	[27,49]
Perceived Risk (PR)	<p>PR1: The decision of whether to use e-textbook is risky.</p> <p>PR2: Providing personal information to e-textbook is risky.</p> <p>PR3: In general, I believe using e-textbook is risky.</p>	[27]
Perceived Usefulness (PU)	<p>PU1: Using e-textbooks would enhance my effectiveness in learning.</p> <p>PU2: Using e-textbooks in my studies would increase my productivity.</p> <p>PU3: Using e-textbooks would enhance my study effectiveness.</p> <p>PU4: I find it useful to use e-textbooks in my studies.</p>	[27,44]
Ease of Use (EU)	<p>EU1: Using e-textbooks is clear and understandable.</p> <p>EU2: Using e-textbooks does not require a lot of mental effort.</p> <p>EU3: I find e-textbooks to be easy to use.</p>	[27,44]
Compatibility (CT)	<p>CT1: Using e-textbooks fits with the way I study.</p> <p>CT2: Using e-textbooks fits with my study preferences.</p> <p>CT3: Using e-textbooks fits my learning needs.</p> <p>CT4: Using e-textbooks fits my learning style.</p>	[26,27]
Subject Norm (SN)	<p>SN1: My classmates are very supportive of using e-textbooks.</p> <p>SN2: I use e-textbooks because others in my class think I should use them.</p> <p>SN3: People important to me think I should use e-textbooks.</p>	[25,27]

Table A1. Cont.

Constructs	ID: Items/Measure	Original source
Self-Efficacy (SE)	SE1: I would feel comfortable using e-textbooks on my own. SE2: If I wanted to, I could easily operate any of the e-textbook reading devices on my own. SE3: I would be able to use the e-textbook device even if there was no one around to show me how to use it.	[26,27]
Facilitating Conditions (FC)	FC1: I have the resources necessary to use the system. FC2: I have the necessary knowledge to use the system. FC3: The system is compatible with other systems I use. FC4: A specific person (or group) is available for assistance with system difficulties.	[7,27]
Attitude (AT)	ATT1: Using e-textbooks is a wise idea. ATT2: I like the idea of using an e-textbook. ATT3: Using e-textbooks would be pleasant.	[25,27]
Perceived Behavioral Control (PBC)	PBC1: I would be able to use e-textbooks. PBC2: Using e-textbooks is entirely within my control. PBC3: I have the resources, knowledge and abilities to make use of e-textbooks.	[26,27]
Behavioral Intention (BI)	BI1: I intend to use e-textbooks this term. BI2: I intend to use e-textbooks frequently this term. BI3: Given that I had access to e-textbooks, I predict that I would use them.	[25,27]
Academic Achievement (AA)	AA1: e-textbooks are useful to me as a student. AA2: e-textbooks have a positive impact on my Academic Achievement. AA3: e-textbooks help me to achieve my academic goals. AA4: The use of e-textbooks helps to improve my contact with my colleagues and teachers as well as my performances academic. AA5: Skills and knowledge obtained during studying e-textbooks are very important to my performance and academic achievement. AA6: I know the most important concepts and facts relating to e-textbooks communications have improved. AA7: The study of topics related to e-textbooks has a positive impact on my life in the future.	[21]

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