

Students' intentions to purchase electronic textbooks

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Abstract Textbooks have played an important role in education for decades. Given the significant number of technology applications in education, it is not surprising that at least one such application is the electronic textbook (e-textbook). There are a variety of motivations to adopt an e-textbook, including frequent content updates and low costs. The research presented here examines students' behavioral intentions to purchase an e-textbook when given the choice. The theoretical foundation of the research is provided by social cognitive theory. The data used in the empirical study were collected by distributing a questionnaire to students at a medium-sized university in the western United States. Student responses used in the analysis all reported prior use of an e-textbook. The model was estimated using a structural equations approach. The results showed that both ease of e-textbook use and verbal persuasion/social norm positively influence behavioral intentions to purchase an e-textbook through both self-efficacy and outcome expectancy/usefulness. Previous computer experience positively influences behavioral intentions to purchase an e-textbook only through self-efficacy. Based on these results, conclusions are provided.

Keywords Electronic textbook · Self-efficacy · Outcome expectancy/usefulness · Behavioral intentions to purchase

Introduction

The textbook has played an important role in higher education for decades providing students with content and answers to questions outside the classroom (Sweeney

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et al. 1983). Given the numerous applications of technology to an educational setting in recent years, it is no surprise that some of these applications are to the traditional textbook. Applying technology to the textbook has created the electronic textbook (e-textbook). There are both faculty and student motivations for adopting e-textbooks. From a faculty perspective, e-textbooks allow content to be updated by the publisher between editions of a traditional, paper-based textbook (Stewart 2009). In dynamic content areas this is an important feature. A student motivation for purchasing an e-textbook is its lower cost, compared to a traditional paper-based textbook. Some of the new e-textbook pricing models include free access to read online, donations to a program or cause, or paying an academic term fee (Beezer 2009; Rampell 2008; Stewart 2009).

University students view computer ownership, social networking, texting, and tweeting as ubiquitous functions (Ellison et al. 2007), making the adoption and use of an e-textbook a natural transition. Mobility is also a consideration as students are trading university email systems for more mobile technologies such as Skype, Facebook messaging, and web-based emails (Brown 2009; Niemuth 2010). With a desire for mobility and the familiarity with technology, why haven't more students accepted and adopted e-textbooks?

It is within the context of students' adoption of e-textbooks that this research is based. Specifically, the research presented examines students' attitudes regarding the use of e-textbooks and their behavioral intentions to purchase them in the future. The research is grounded in social cognitive theory. The objective is to link student attitudes and behavioral intentions to observable and manageable variables using this model. The ultimate hope is to make recommendations regarding how faculty, if they desire, can influence the manageable variables to successfully influence students' attitudes and behavioral intentions to voluntarily purchase e-textbooks.

Literature review

Although the pedagogical methods for teaching have changed over the years, a course textbook is still an important resource to support lecture material. Providing content electronically is a rapidly growing industry for education (Dillon 2008; Hill 2010; Nelson and Hains 2010). E-books, digital textbooks, and online textbooks represent some of the terms being used to describe transferring textbook information from a paper-based version to a digital format (Allen 2009; Ballhaus et al. 2010; Seidel 2009; Shiratuddin et al. 2003). This research uses the term e-textbooks because it encompasses the digitization of academic textbook information retrieved via a computer whether viewed online or downloaded to a computer. The e-textbook term focuses on the mechanism for retrieving as well as reading the electronic, digital information and not the media used to view the information (i.e., electronic reader, laptop, printed electronic information).

While the use of electronic content has grown in education, students need to accept the changing content retrieval and use methods. Student acceptance of the technology is dependent on the user believing he or she will benefit by the change (Birch and Irvine 2009). Increasing availability of e-textbooks in the past few years

is providing more opportunity for students to use digital textbook content (Reynolds 2011) thus helping drive down the cost of e-textbooks indicating a strong determinant of student acceptance. Weisberg (2011) conducted a 2-year longitudinal study using a variety of textbook delivery methods and found students becoming more receptive to e-textbooks. Gender, computer experience, and previous use of e-texts weren't significant in swaying student attitudes toward accepting e-textbooks (Woody et al. 2010). Although e-textbooks provide students with portability and convenient access a user still needs to change their behavior.

Self-efficacy plays an important part in understanding why a user may expend more effort to change behavior. Self-efficacy theory (Bandura 1986; Bates and Khasawneh 2007) is based on social cognitive theory (Bandura 1977, 1982; Martinko et al. 1996) and links an individual's cognitive state to a variety of affective and behavioral outcomes (Staples et al. 1998). Students with low self-efficacy feel a lack of control over their actions and are less motivated and less persistent with changing a behavior or seeing value in the change (McQuiggan et al. 2008).

Bandura (1986) separated the affective and behavioral outcomes into two distinct types, self-efficacy and outcome expectancy. An individual's belief that he or she possesses the skills and abilities to successfully accomplish a specific task represents self-efficacy. Outcome expectancy or what we have called outcome expectancy/usefulness is an individual's belief that accomplishing a task produces a desired outcome. Self-efficacy and outcome expectancy/usefulness have separate influences on behavior and effect. However, self-efficacy typically has a larger effect than outcome expectancy/usefulness (Bandura 1986). Generally, self-efficacy has a direct effect on outcome expectancy/usefulness (Stone and Henry 2003).

In self-efficacy theory, four groups of constructs are proposed to directly affect self-efficacy and outcome expectancy/usefulness. These are all related to the task to be performed and include past experience or mastery, vicarious experience, emotional or physiological arousal, and verbal persuasion/social norms. These constructs affect attitudes toward the task, behavioral intentions to perform the task, and ultimately task performance through self-efficacy and outcome expectancy/usefulness.

Previous research using self-efficacy theory has explained individual's reactions in a variety of contexts including reactions to information technologies (Bandura 1986; Baronas and Louis 1988; Hasan 2003; Havelka 2003; Martinko et al. 1996; Meier 1985; Potosky 2002).

If individuals perceive they have the skills and abilities to accomplish a task or adopt a technology, they will demonstrate greater persistence at the task or in the use of the technology (Tsai and Cheng 2010). Furthermore, if a technology is perceived to be useful (i.e., outcome expectancy/usefulness), an individual is more likely to adopt and use it now and in the future (Henry and Stone 2001; Martinko et al. 1996). Outcome expectancy/usefulness can have a positive or negative consequence on behavioral acceptance (Luszczynska et al. 2005). Negative outcome expectancy/usefulness may be represented by discomfort or refusal to change behavior; positive outcome expectancy/usefulness may be represented by satisfaction in a behavioral change. Within the context at hand, student perceptions of

self-efficacy and outcome expectancy/usefulness influence their attitudes toward and intentions to purchase an e-textbook.

A technology that is mandatory may inflate its use, but the perception of usefulness is still present (Iivari 2005). Rai et al. (2002) defined “quasi-volitional IT use” as un-mandated use of a system but not completely volitional because of social pressure and subjective norms in the environment. This means that a student may not be required to use the technology, but the context influences their behavior to use it. The adoption or purchase of an e-textbook could be completely volitional or non-volitional depending upon the textbook options students are given by the instructor. However, many students today are comfortable purchasing their own substitute textbook from one of several sources available to them regardless of what the instructor selects for the book order. In this regard, purchasing an e-textbook or another form of a textbook is, or might well be a volitional act by the student.

The model

Based on the literature and the context of this investigation (i.e., students’ use of e-textbooks), a model was developed. The logic underlying the model and the model itself are summarized in Fig. 1. Intuitively, to receive a return on an investment in new technology such as the purchase of an e-textbook, an individual must accept it (Yi and Hwang 2003). Acceptance depends on the student’s belief that the e-textbook is beneficial, provides capabilities to complete tasks, is easy to use, and is something that important reference groups encourage students to use. The developed model has three antecedents: previous computer experience (mastery), ease of e-textbook use (emotion or physiological arousal), and the encouragement to use e-textbooks from individuals important to the student (verbal persuasion/social norm). These antecedents are proposed to directly affect the students’ self-efficacy

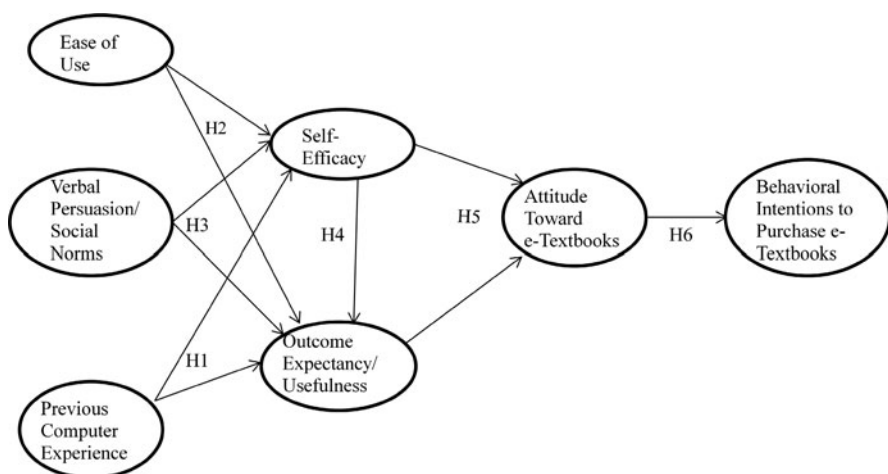


Fig. 1 The theoretical model and hypotheses regarding student’s perceptions of e-textbooks

to use e-textbooks and the perceived outcome expectancy/usefulness from the use of e-textbooks. Both self-efficacy and outcome expectancy/usefulness are proposed to directly affect the students' attitudes regarding e-textbooks and ultimately students' behavioral intentions to purchase an e-textbook. The model is shown in Fig. 1 along with the testable hypotheses.

Previous computer experience

Recent research on computer self-efficacy investigates the construct of previous computer experience with a variety of demographic predictors (Barbeite and Weiss 2004; Havelka 2003; Potosky and Bobko 1998). From Havelka's research (2003), significant differences in self-efficacy ratings regarding computers were found for information systems and economics majors compared to management majors. The differences in prior experiences as represented by different academic fields may play a role in influencing self-efficacy levels. Some research has looked at individual experiences and their effects on self-efficacy. If a person has more computer experience, particularly in certain areas of computer programming and graphic applications, he or she tends to report higher self-efficacy (Busch 1995; Hasan 2003; Havelka 2003; Wilson and Shrock 2001). Furthermore, experience leads to expectations of the usefulness or outcomes from completing the task. As a result, hypotheses 1.1 and 1.2 are proposed.

Hypothesis 1.1 (H1.1) Previous computer experience positively affects self-efficacy regarding e-textbooks.

Hypothesis 1.2 (H1.2) Previous computer experience positively affects outcome expectancy/usefulness regarding e-textbooks.

Ease of use

The perception of a task and its completion regarding emotional or physiological arousal from using the technology influences self-efficacy (Bandura 1986). Intellectual interest in a task or perceptions of how easy the task is to complete improves an individual's perception of self-efficacy and the value of completing the task (i.e., outcome expectancy/usefulness). Negative assessments of one's efficacy and the task outcome can be produced from anxiety regarding performing the task (Bandura 1977, 1986). Thus, emotional or physiological arousal affects perceptions of self-efficacy and outcome expectancy/usefulness. One such aspect of arousal is ease of system use. The ease in using the system influences completion of the task (Compeau and Higgins 1995). The influence of ease of use has been identified in empirical studies based on the technology acceptance model (Davis 1989; Venkatesh and Davis 2000; Venkatesh et al. 2003). This literature implies hypotheses 2.1 and 2.2 as stated below.

Hypothesis 2.1 (H2.1) Perceived ease of use positively affects self-efficacy regarding e-textbooks.

Hypothesis 2.2 (H2.2) Perceived ease of use positively affects outcome expectancy/usefulness regarding e-textbooks.

Verbal persuasion/social norm

The final antecedent in the model, encouragement from individuals important to the student (verbal persuasion/social norm), occurs when these individuals provide support and encouragement in the students' use of the e-textbook. Supportive encouragement and feedback can make the difference in the successful implementation and adoption of systems through affecting users' self-efficacy for completing the task and perceived value from completion (Henry and Stone 1995a, b). From this literature, hypothesis 3 is developed and presented below.

Hypothesis 3.1 (H3.1) Verbal persuasion/social norm positively affects self-efficacy regarding e-textbooks.

Hypothesis 3.2 (H3.2) Verbal persuasion/social norm positively affects outcome expectancy/usefulness regarding e-textbooks.

Self-efficacy and outcome expectancy/usefulness

The self-efficacy regarding completing a task affects the individual's perception of the outcomes or usefulness of completing the task (Henry and Stone 1995a). In the context of students and e-textbooks, students' perceptions of their self-efficacy to use an e-textbook affect their perceptions of outcome expectancy/usefulness of these texts. As a result, we offer hypothesis 4.

Hypothesis 4 (H4) Self-efficacy regarding the use of an e-textbook positively affects outcome expectancy/usefulness regarding e-textbooks.

Perceptions of self-efficacy affect attitudes toward the task (Bandura 1982). This implies that students' self-efficacy regarding e-textbooks affect the students' attitudes toward these texts. Outcome expectancy/usefulness regarding a task theoretically affects attitudes toward the task (Bandura 1986). In the specific task context of computer security behaviors, outcome expectancy/usefulness perceptions of security behaviors significantly affect individuals' attitudes towards these behaviors (Pendegraft et al. 2010). Similarly, we propose that students' expectations of outcome expectancy/usefulness of an e-textbook positively affect their attitudes toward these texts. Based on this literature, we offer hypothesis 5.

Hypothesis 5.1 (H5.1) Self-efficacy positively affects attitudes regarding e-textbooks.

Hypothesis 5.2 (H5.2) Outcome expectancy/usefulness positively affects attitudes regarding e-textbooks.

Attitudes

Social cognitive theory as developed by Bandura (1982) proposes that attitudes regarding a task influence the individual's behavioral intentions to perform that task. This relationship has received empirical support in applied settings as well (Pendegraft et al. 2010). Applied to the research at hand, students' attitudes toward e-textbooks positively affect their behavioral intentions to purchase an e-textbook. As a result, we propose hypothesis 6.

Hypothesis 6 (H6) Attitudes toward e-textbooks positively affect the behavioral intentions to purchase an e-textbook.

In summary, the hypothesized model relates the antecedents of self-efficacy and outcome expectancy/usefulness to students' attitudes and ultimately behavioral intentions to purchase e-textbooks. More specifically, the theoretical model links the antecedents of previous computer experience, encouragement and support of individuals important to the student, and ease of the e-textbook's use to outcome expectancy/usefulness and self-efficacy. The model also predicts that self-efficacy affects outcome expectancy/usefulness, and both expectancies are hypothesized to affect students' behavioral intentions to purchase e-textbooks through students' attitudes regarding e-textbooks.

The method

The participants

The data to empirically test the theoretical model were collected using a survey of students at a mid-sized university in the western United States. The questionnaire was web-based and distributed using Qualtrics. An invitation to participate was distributed via a student listserv to 11,957 students. A total of 1,382 responses were received producing an 11.56 % response rate. Among these 1,382 responses, 646 respondents or 47 % reported prior use of an e-textbook. Due to a significant number of missing responses to items, there were 529 usable responses from those who had used an e-textbook. It should be noted that the sample size to the university student population is 4.42 %. However, this ratio underestimates the sample response since the desired target population is students who have used an e-textbook, not the entire student population. Unfortunately, the number of students at the university who have used an e-textbook is unavailable and using the entire student population of the university in this ratio underestimates the sample to population response rate.

The sample characteristics are reported in Table 1. The average age of the sample respondents was 23.39 years while for the university student population the average age was 21.80 years. Over 57 % of the respondents were female while for the university this average is 46 %. The students were also asked to self-report the college in which they were enrolled. The most frequently reported colleges were business and economics and letters, arts and social sciences at approximately 22 %

Table 1 The sample characteristics

Age	Sample (years)	University (years)	
Average	23.39	21.80	
	Sample frequency	Sample %	University %
Gender			
Male	219	41.40	54.30
Female	303	57.28	45.70
Missing values	7	1.32	0.00
Total	529	100.00	100.00
College enrolled			
Agriculture and life sciences	55	10.40	10.36
Art and architecture	23	4.35	6.99
Business and economics	119	22.50	10.53
Education	50	9.45	14.61
Engineering	80	15.12	14.62
Letters arts and social sciences	116	21.93	28.35
Natural resources	31	5.86	6.12
Science	46	8.70	8.42
Missing values	9	1.70	00.0
Total	529	100.01	100
Amount of daily computer use	Frequency	Sample %	
<1 h	3	0.57	
1–2 h	45	8.51	
3–5 h	256	48.39	
6–9 h	157	29.68	
>9 h	61	11.53	
Missing values	7	1.32	
Total	529	100.00	
I have own desktop computer	Frequency	Sample %	
Yes	199	37.62	
No	319	60.30	
Missing values	11	2.08	
Total	529	100.00	
I have own laptop computer	Frequency	Sample %	
Yes	490	92.63	
No	29	5.48	
Missing values	10	1.89	
Total	529	100.00	

each. For the university student population the percentage enrollment in letters, arts and social sciences was 28.35 % and in business and economics it is 10.53 %. Another large percentage enrollment difference between the sample and the university is in education at slightly more than a 5 % difference. The differences between the sample and university values for these sample characteristics require some discussion. A potential explanation for the over representation of business and economics students in the sample may be due to the fact that faculty from this college distributed the questionnaire. This might have encouraged business and economics students to respond at rates higher than expected by their percentage in the university. Additionally, because business and economics students usually do not enroll in business courses until their second year at the university, the over representation of business students is a potential explanation for the slightly older average age of respondents compared to the university as a whole. The gender difference between the sample and the university student population requires additional study before even a potential explanation can be proposed.

The remaining sample characteristics reported in Table 1 do not have corresponding values for the university student population. For the amount of daily computer use, the most frequently reported category at just over 48 % of the respondents was 3–5 h per day. Six to nine hours per day was the second most frequently reported category at just less than 30 %. Slightly more than 60 % of the responding students reported that they did not own a desktop computer while over 92 % said they had a laptop computer.

The measures

The measures were formed by collecting student responses to a series of questionnaire items. For all items, the students were given a statement and a scale upon which to respond. For the three questionnaire items measuring the verbal persuasion/social norms construct, respondents were given a five-point scale with anchors of 1—very unlikely, 2—unlikely, 3—undecided, 4—likely, and 5—very likely. All the remaining items used a similar scale with anchors of 1—strongly disagree, 2—disagree, 3—neither agree or disagree, 4—agree, and 5—strongly agree. The items forming the measures and these items' means and standard deviations are shown in Table 2. Table 3 displays the correlation matrix for these items.

Data analysis of the measures

The psychometric properties of the measures are shown in Table 4. The psychometric properties of the measures are calculated using the results of a confirmatory factor analysis. The confirmatory factor analysis allowed each measure or factor to pair-wise correlate and be reflective in its indicants. The factors or latent variables were scaled by setting their standard deviations to one. Estimation was done using PC SAS version 9.2, procedure Calis, and maximum likelihood estimation. The results from the confirmatory factor analysis are illustrated in Fig. 2.

Table 2 The means and standard deviations of the indicants

Indicant	Mean	SD
Ease of use		
1. I find e-textbooks easy to use	3.11	1.17
2. I find it easy to do what I want to do using an electronic textbook	2.98	1.17
3. I would find an electronic textbook easy to use	3.17	1.20
Attitude toward e-textbooks		
4. I am pleased with how e-textbooks facilitate my studying	2.91	1.19
5. e-textbooks fit well with how I read and study	2.61	1.22
6. I am satisfied with using electronic books for my college courses	2.86	1.26
Behavioral intentions to purchase e-textbooks		
7. The likelihood of purchasing an electronic textbook is ...	3.13	1.22
8. My willingness to buy an electronic textbook is ...	3.08	1.29
Outcome expectancy/usefulness		
Using an electronic textbook helps ...		
9. Me do a better job in my classes	2.62	0.99
10. Improves my quality of academic work	2.61	1.00
11. Make me more successful in class	2.65	1.02
12. Improves my academic performance	2.64	1.04
Verbal persuasion/social norms		
13. My classmates think I should use an electric textbook	2.71	0.75
14. My professors think I should use an electronic textbook	2.83	0.72
15. My parents think I should use an electronic textbook	2.61	0.84
Self-efficacy		
16. I feel more competent using e-textbooks than most of my classmates	2.98	0.93
17. I know enough to successfully use e-textbooks	3.95	0.88
Previous computer experience		
18. I have used computers throughout my academic experiences	4.63	0.66
19. I have used computers over a long period of time	4.66	0.58

In structural equations modeling, as is the case here, the fit of the proposed model to the data is influenced by a number of factors (e.g., sample size, model complexity, indicant scale). Because of the variety of these factors, typically a number of fit measures are used to evaluate the fit's quality (Hooper et al. 2008). The idea is that different fit measures are more or less sensitive to specific factors and that by using multiple fit measures a more complete view of fit quality is revealed. Further complicating determining the quality of a model's fit is that the acceptable levels or cutoff values for the fit measures can be open to interpretation and for some of these measures, what is generally viewed as acceptable has changed over time (Hooper et al. 2008).

For the confirmatory factor analysis, the fit statistics are reported in Table 6 and indicate an appropriate fit between the model and the data. The goodness of fit index of 0.93 satisfies the traditional cutoff for an acceptable fit, but is less than the more recent

Table 3 The correlation matrix of the indicants

	1	2	3	4	5	6	7	8	9	
1.	1.00									
2.	0.76	1.00								
3.	0.69	0.65	1.00							
4.	0.72	0.79	0.67	1.00						
5.	0.69	0.75	0.65	0.83	1.00					
6.	0.70	0.74	0.67	0.80	0.80	1.00				
7.	0.60	0.67	0.64	0.69	0.67	0.74	1.00			
8.	0.64	0.71	0.69	0.74	0.73	0.80	0.88	1.00		
9.	0.62	0.69	0.60	0.75	0.74	0.75	0.63	0.69	1.00	
10.	0.63	0.70	0.61	0.75	0.74	0.74	0.64	0.68	0.89	
11.	0.61	0.69	0.60	0.72	0.72	0.74	0.63	0.67	0.89	
12.	0.62	0.69	0.62	0.75	0.73	0.75	0.62	0.68	0.87	
13.	0.34	0.39	0.44	0.46	0.42	0.49	0.45	0.49	0.47	
14.	0.16	0.21	0.29	0.29	0.24	0.30	0.31	0.28	0.30	
15.	0.33	0.37	0.38	0.42	0.39	0.47	0.44	0.46	0.41	
16.	0.41	0.41	0.45	0.44	0.42	0.46	0.40	0.44	0.48	
17.	0.41	0.40	0.46	0.40	0.33	0.41	0.36	0.36	0.33	
18.	0.00	0.05	0.05	0.01	0.01	0.05	-0.02	-0.03	0.01	
19.	0.0	0.02	0.07	0.01	-0.01	0.02	0.01	0.02	0.01	
	10	11	12	13	14	15	16	17	18	19
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.	1.00									
11.	0.88	1.00								
12.	0.90	0.91	1.00							
13.	0.45	0.45	0.47	1.00						
14.	0.29	0.31	0.30	0.59	1.00					
15.	0.41	0.42	0.44	0.75	0.58	1.00				
16.	0.45	0.48	0.48	0.31	0.18	0.31	1.00			
17.	0.29	0.32	0.34	0.26	0.12	0.20	0.45	1.00		
18.	0.02	0.01	0.01	-0.01	-0.04	0.02	0.09	0.18	1.00	
19.	-0.01	-0.01	-0.02	0.00	-0.01	0.01	0.15	0.24	0.72	1.00

The row and column numbers refer to the questionnaire item numbers shown in Table 2

Table 4 The indicants, measures, and psychometric properties based on the confirmatory factor analysis

Indicant	Standardized path coefficient	Composite reliability coefficient	Percentage of variance extracted (%)
Ease of use		0.88	71
1. I find e-textbooks easy to use	0.85		
2. I find it easy to do what I want to do using an electronic textbook	0.89		
3. I would find an electronic textbook easy to use	0.79		
Attitude toward e-textbooks		0.93	81
4. I am pleased with how e-textbooks facilitate my studying	0.91		
5. e-textbooks fit well with how I read and study	0.89		
6. I am satisfied with using electronic books for my college courses	0.90		
Behavioral intentions to purchase e-textbooks		0.94	88
7. The likelihood of purchasing an electronic textbook is	0.90		
8. My willingness to buy an electronic textbook is ...	0.98		
Outcome expectancy/usefulness		0.97	88
Using an electronic textbook helps ...			
9. Me do a better job in my classes	0.93		
10. Improves my quality of academic work	0.94		
11. Make me more successful in class	0.94		
12. Improves my academic performance	0.95		
Verbal persuasion/social norms		0.84	65
13. My classmates think I should use an electric textbook	0.88		
14. My professors think I should use an electronic textbook	0.68		
15. My parents think I should use an electronic textbook	0.84		
Self-efficacy		0.66	49
16. I feel more competent using e-textbooks than most of my classmates	0.70		
17. I know enough to successfully use e-textbooks	0.69		
Previous computer experience		0.86	75
18. I have used computers throughout my academic experiences	0.77		
19. I have used computers over a long period of time	0.96		

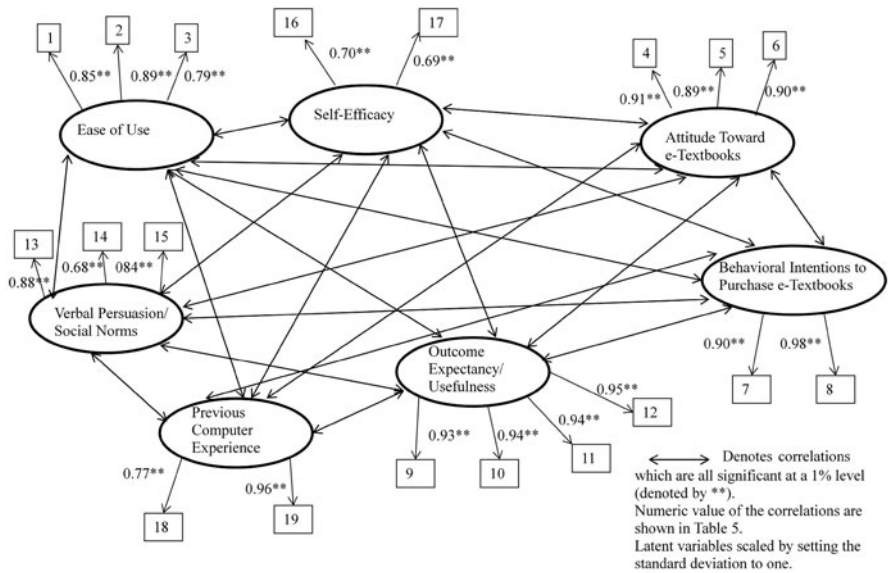


Fig. 2 The confirmatory factor analysis estimation of students' perceptions of e-textbooks

and rigorous value of 0.95. The normed χ^2 statistic value of 2.40 satisfies a generally accepted cutoff of five and is slightly above the more rigorous cutoff of two. All the remaining values for the fit measures satisfy both the traditional and more rigorous cutoff values for an acceptable fit (Hair et al. 1992; Hooper et al. 2008).

The standardized path coefficients from the confirmatory factor analysis are also called pattern coefficients (Thompson 1997). It is these estimates that are used to examine the properties of the measures or factors. The use of the pattern coefficients for this analysis is a common approach when the confirmatory factor analysis is an intermediary step in the overall analysis (Hair et al. 1992). The ultimate goal of the study is the evaluation of the theoretical model represented by the structural or path model. This approach has been referred to as a two-step approach in which confirmatory factor analysis is performed first to assess the measurement model then structural equations is used to assess the structural model (Anderson and Gerbing 1988). The confirmatory factory analysis was performed to evaluate the psychometric properties of the measures representing the constructs in the theoretical model. Furthermore, the theory dictates which of the pattern coefficients are to be constrained to zero (Hair et al. 1992). It should also be noted that as in this case, given that the latent constructs or factors are standardized and the indicators share the same scale, the pattern coefficient estimates equal the structural coefficient estimates (Thompson 1997).

Ease of use was formed by three questionnaire items and had standardized path coefficients from the confirmatory factor analysis with magnitudes ranging from 0.79 to 0.89 indicating satisfactory item reliabilities. Its composite reliability

coefficient (i.e., sum of the standardized path coefficients squared divided by the sum of the squared standardized path coefficients plus the sum of the measurement error) was 0.88 with a percentage of variance extracted of 71 %. The students' attitudes toward e-textbooks variable also had three items. The standardized path coefficients and implied item reliabilities were between 0.89 and 0.91. The variance extracted for this measure was 81 %, and its composite reliability was 0.93. Students' behavioral intention to purchase e-textbooks was measured by two items with standardized path coefficients of 0.90 and 0.98 indicating satisfactory item reliabilities. The measure had a composite reliability coefficient of 0.94 and variance extracted of 88 %. Outcome expectancy/usefulness was developed using four questionnaire items. The standardized path coefficients and resulting item reliabilities ranged from 0.93 to 0.95. The composite reliability coefficient was 0.97 with extracted variance of 88 %. The verbal persuasion/social norms measure was built using three items. The standardized path coefficients and item reliabilities for these items were 0.88, 0.68, and 0.84, and the composite reliability coefficient was 0.84. The variance extracted was 65 %. The two remaining measures were constructed with two questionnaire items each. The self-efficacy items had standardized path coefficients and item reliabilities of 0.69 and 0.70. Its composite reliability coefficient was 0.66, and its extracted variance was 49 %. For the previous computer experience variable, the standardized path coefficients were 0.77 and 0.96 with a composite reliability coefficient of 0.86 and 75 % extracted variance.

Based on the magnitude of the confirmatory factor analysis standardized path coefficients, item reliability is satisfied, with the possible exceptions of one item in the verbal persuasion/social norms measure and one in the self-efficacy measure (Rainer and Harrison 1993). These two items had estimated path coefficients of 0.68 and 0.69 while all the other items had standardized path coefficients of 0.70 or higher. In terms of composite reliability, all the measures except self-efficacy demonstrate adequate values of this trait (Rainer and Harrison 1993). The self-efficacy measure had a composite reliability coefficient of 0.66, slightly below a generally accepted cutoff level of 0.70 (Nunnally 1978). The remaining measures had composite reliability coefficients ranging from 0.84 to 0.97. These results indicate that the measures, with the possible exception of self-efficacy, satisfy convergent validity (Rainer and Harrison 1993; Igbaria and Greenhaus 1992).

Discriminant validity was also examined to see if each indicant can discriminate between its own measure and all other measures in the study. Given the focus of the confirmatory factor analysis as an intermediate step in the ultimate aim of the study, the examination of the theoretical model, discriminant validity was evaluated in the context of the defined measures. In other words, discriminant validity was evaluated using the pattern coefficients and measures.

Discriminant validity was examined by comparing, for each pair of measures, their squared correlation to both measure's percentage of variance extracted. If discriminant validity is satisfied, the items within a measure share greater common variation among themselves than with the items in the other measures. Within this context, discriminate validity is satisfied for each measure pair if the individual measures' percentages of variance extracted are greater than the squared correlation

between the two measures (Fornell and Larcker 1981). For these results, discriminant validity is satisfied for all pairs of measures except ease of use and attitude toward e-textbooks. The squared correlation between the measures was 0.88 while the extracted variance for each measure was 71 and 81 %. All the squared correlations are reported in Table 5 and the percentages of variance extracted in Table 4.

These values provide mixed results regarding the psychometric properties for the measures. The self-efficacy measure lacks convergent validity. Furthermore, the ease of use measure and attitudes toward e-textbooks measure do not satisfy discriminant validity. This implies that the indicants of these two measures are highly correlated and as result have difficulty differentiating between the two measures. All the other measures satisfy both convergent and discriminant validity and hence construct validity (Hair et al. 1992). The measures with problems regarding their psychometric properties require additional refinement. Even with these issues, the psychometric properties are sufficient to continue with the study.

Table 5 The correlations and squared correlations among the measured based on the confirmatory factor analysis

Measure pair	Correlation	Squared correlation
Ease of use-attitude toward e-textbooks	0.94	0.88
Ease of use-behavioral intentions to purchase e-textbooks	0.80	0.64
Attitude toward e-textbooks—behavioral intentions to purchase e-textbooks	0.84	0.71
Ease of use-outcome expectancy/usefulness	0.81	0.66
Attitude toward e-textbooks—outcome expectancy/usefulness	0.87	0.76
Behavioral intentions to purchase e-textbooks—outcome expectancy/usefulness	0.72	0.52
Ease of use-verbal persuasion/social norms	0.47	0.22
Attitude toward e-textbooks—verbal persuasion/social norms	0.55	0.30
Behavioral intentions to purchase e-textbooks—verbal persuasion/social norms	0.55	0.30
Outcome expectancy/usefulness—verbal persuasion/social norms	0.53	0.28
Ease of use-self-efficacy	0.69	0.48
Attitude toward e-textbooks—self-efficacy	0.62	0.38
Behavioral intentions to purchase e-textbooks—self-efficacy	0.53	0.28
Outcome expectancy/usefulness—self-efficacy	0.58	0.34
Verbal persuasion/social norms—self-efficacy	0.41	0.17
Ease of use-previous computer experience	0.02	0.00
Attitude toward e-textbooks—previous computer experience	0.02	0.00
Behavioral intentions to purchase e-textbooks—previous computer experience	-0.02	0.00
Outcome expectancy/usefulness—previous computer experience	-0.01	0.00
Verbal persuasion/social norms—previous computer experience	-0.01	0.00
Self-efficacy-previous computer experience	0.29	0.08

However, the ultimate model estimation results need to be interpreted and conclusions drawn with caution.

The estimation of the model

The model displayed in Fig. 1 was defined by the measures and their indicants and estimated using a structural equations approach. The estimation was done in PC SAS version 9.2 using procedure Calis and maximum likelihood estimation. The questionnaire items were used as reflective indicants of their respective constructs. The exogenous latent variables were scaled by setting their standard deviations equal to one. The endogenous latent variables were scaled by setting the coefficient on its first indicant equal to one.

The quality of the fit between the model and the data was summarized by several statistics that are shown in Table 6. As discussed in connection with the confirmatory factor analysis, a variety of fit measures are presented to evaluate the quality of the model's fit. The normed χ^2 value of 3.42 satisfies a traditionally used cutoff value of five, but not the more stringent value of two that is also used. Four other fit measures also satisfy the traditional cutoff values of an acceptable fit, but not more stringent criteria that have been more recently proposed. These measures were the goodness of fit at 0.90 while the more stringent value is 0.95. The root mean square error of approximation is 0.075 which satisfies the traditional cutoff of 0.08, but not the more recent, stringent value of 0.06. The last of these fit measures are the normed fit measures of Bollen, Bentler and Bonett. These values were 0.93 and 0.94 respectively which satisfy the traditional cutoffs of 0.90 but are slightly below more recent values of 0.95 (Hair et al. 1992; Hooper et al. 2008).

The remaining fit measures satisfy both the traditional and more recent criteria of fit quality. The first of these measures is the root mean square error of approximation confidence interval which was in the range from 0.07 to 0.08. Bentler's comparative fit index was 0.96 as was Bollen's non-normed fit index. Bentler and Bonett's non-normed fit index was 0.95. Finally, the parsimonious

Table 6 The statistics summarizing the fits of the confirmatory factor analysis and the model

Statistic	Confirmatory factor analysis	Model estimation
Goodness of fit index	0.93	0.90
Normed χ^2 statistic	2.40	3.42
Root mean square error of approximation (RMSEA)	0.06	0.075
RMSEA lower limit (90 %)	0.05	0.07
RMSEA upper limit (90 %)	0.06	0.08
Bentler's comparative fit index	0.98	0.96
Bentler and Bonett's non-normed index	0.97	0.95
Bentler and Bonett's normed index	0.96	0.94
Bollen normed index	0.95	0.93
Bollen non-normed index	0.98	0.96
Parsimonious goodness of fit index	0.71	0.75

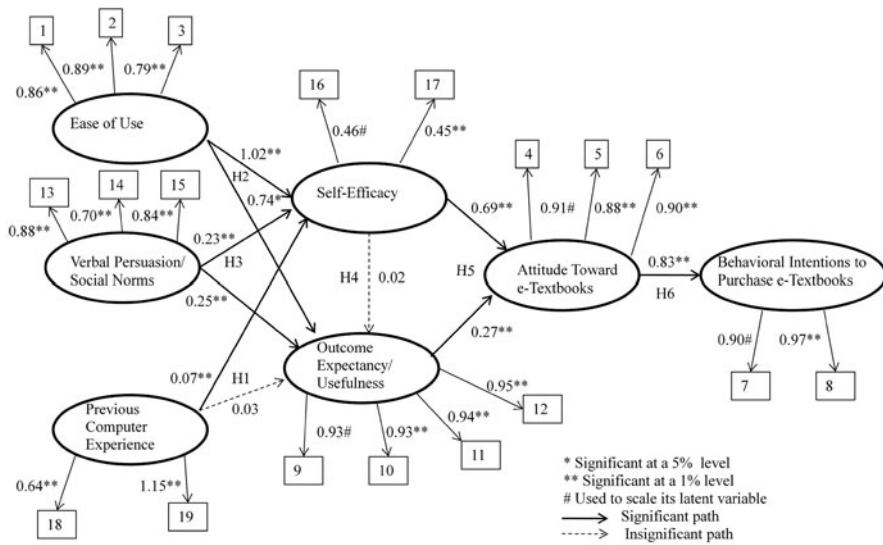


Fig. 3 The estimation results regarding student's perceptions of e-textbooks

goodness of fit was 0.75 and was above the frequently used cutoff of 0.50 (Hair et al. 1992; Hooper et al. 2008).

The resulting estimated model is displayed in Fig. 3. All the estimated paths between the indicators and their respective measures are statistically significant at a 1 % level. The empirical results for the structural model indicate that ease of use (H2) and verbal persuasion/social norms (H3) significantly affect self-efficacy and outcome expectancy/usefulness. Previous computer experience had meaningful influences on self-efficacy, but not on outcome expectancy/usefulness. Furthermore, self-efficacy and outcome expectancy/usefulness (H5) had meaningful, positive influences on attitudes towards e-textbooks which in turn had a positive effect on students' behavioral intentions to purchase an e-textbook (H6). The insignificant paths were between previous computer experience to outcome expectancy/usefulness (H1.2) and self-efficacy to outcome expectancy/usefulness (H4).

Discussion

This research focused on linking student attitudes and behavioral intentions to the adoption of e-textbooks. However, the study's empirical results need to be interpreted within the study's limitations. First, the definition of an e-textbook was rather generic and did not consider the variety of technologies that can be used in the presentation and use of digital material. This makes for a narrow interpretation of the empirical results. Second, the sample size of 529 is reasonably large, but there is no good method for determining the presence of non-response bias in the sample since the target population of students who have used an e-textbook could not be

identified. While doubtful, it may well be the empirical results are due to a less than perfectly representative sample.

An additional, potential limitation of the study is the two-indicator measures used in the empirical study. The concern in using two-item measures revolves around adequate coverage of the construct's content domain. Is the defined measure providing a comprehensive representation of the theoretical construct? However, there are numerous published examples in which two-item measures are used (Hair et al. 1992, pp. 453–456; Hughes et al. 1986; Henry and Stone 1999). While not a fatal flaw, empirical results using two item measures must be interpreted carefully. Similarly, careful interpretation of the empirical results is required due to the described psychometric properties of the measures used in the study.

In a study conducted by Pearson Foundation, it was found that although the price of e-textbooks are “60 % lower than the print editions” (Rachlin 2011) adoptions have been relatively modest but the rise in tablet computers and technologies such as iPads are starting to spur greater acceptance of e-textbooks. With the expansion of tablet computing, more digital content and e-textbooks should see more acceptance by students. An interesting future research question is once a student has used an e-textbook, do they volunteer to use one in future courses?

Based on the results for this research of initial e-textbook adoptions, it appears that, if an e-textbook is easy to use, there are positive, meaningful affects on students' attitudes toward e-textbooks and behavioral intentions to purchase e-textbooks. The ease of use measure could encompass the ability of students to access and download the text as well as to actually use the e-textbook. The implication for faculty considering requiring an e-textbook is in selecting the e-textbook in part based on usability for students.

The verbal persuasion/social norms measure considered the influences of the students' parents', classmates', and professors' perspectives on these students' use of e-textbooks. These perspectives positively affect the students' attitudes regarding e-textbooks and their behavioral intentions to purchase e-textbooks. While faculty cannot control the perspectives of parents and classmates directly, they can partially control their own perspectives and influences on students. Through encouraging students' use of e-textbooks, faculty can influence students' attitudes and behavioral intentions regarding e-textbooks.

Previous computer experience also affects students' attitudes and behavioral intentions to purchase e-textbooks through self-efficacy. Prior computer experience from both formal training and informal use, positively affects students' self-efficacy regarding their abilities to successfully use e-textbooks. From a faculty member's perspective, this could mean making sure that the typical student enrolled in a specific course has appropriate experiences to successfully use an e-textbook before requiring an e-textbook.

Conclusions

E-textbooks are a growing trend in higher education. In South Korea, for example, there are plans to do away with paper-based textbooks and digitize all content

starting in elementary school by 2014 (Sang-ho 2011). As with any new technology adoption, its success or failure depends on numerous factors. The research presented here identifies several of these important factors regarding students' attitudes towards and behavioral intentions to purchase e-textbooks. Furthermore, faculty have methods to influence students' attitudes and behavioral intentions to purchase e-textbooks. These methods include selecting an e-textbook considering student usability; making sure that the typical student enrolled in the course has requisite prior computer skills whether gained formally or informally (e.g., computer use via social networking or gaming); and encouraging students' use of e-textbooks.

Additional research is needed for understanding the medium to read e-textbooks. With the field of computer tablets and iPad-like devices increasing, understanding the usability of the device and display mechanisms should provide further insight into the acceptance of e-textbooks.

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