Acceptance Scale of Interactive E-Books By Secondary School Students as a Digital Learning Resource: A Validity and Reliability Study

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Abstract

This study aimed to develop a measurement tool to determine the level of acceptance and use of interactive digital e-books by secondary school students. With the acceptance scale towards interactive e-books of secondary school students (IE-BAS), it is envisaged to determine both in-class activities and activity efficiency. The technology acceptance model (TAM) was used as a basis for the development process of IE-BAS. In the study, the scale development process was composed of content and construct validity sections. The content validity of draft IE-BAS is provided by expert opinions. In construct validity studies, exploratory factor analysis (EFA) revealed that the draft IE-BAS clustered in four factors indicating cognitive, affective, and behavioral responses. Confirmatory factor analysis (CFA) was used to prove the accuracy of the proposed model in EFA. As a result of CFA, the fit indices for the model-data fit were quite good. Accordingly, the RMSEA, SRMR, GFI, AGFI, NFI, CFI, and RFI value was determined as 0.043, 0.058, 0.924, 0.901, 0.909, 0.966, and 0.892, respectively. Also, the effects of the variables in the 20-item IE-BAS on each other were examined by structural equation modeling (SEM). Accordingly, the behavioral intention (BI) variable, which shows the behavioral response of the students, is significantly affected by the perceived ease of use (PEU), attitude towards use (UA), and perceived usefulness (PU) variables. The results showed that the developed 20-item productive IE-BAS is a valid and reliable scale to measure secondary school students' acceptance towards interactive e-books as a digital learning environment.

Keywords: Validity, reliability, interactive e-book, technology acceptance model

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Introduction

Students actively develop their potential to have self-control, personality, intelligence, and skills needed by society (Ünveren Kapanadze, 2019). It is possible to achieve these skills through education. Developing countries argue that education is the most important key to happiness and financial protection in the future (Thut & Adams, 2005). If today's economy is to be named the economy of information and technology, every society aims to develop human resources by including information technologies in every field from education to health, and to try to gain a place for themselves by putting lifelong education in the forefront (Arı, 2010). Information and communication technologies, which are thought to be at the center of technological developments with globalization, are now an indication that the society we live in is an information society (Yılmaz & Horzum, 2005). The increase in the production of information and the development of technology has brought innovations in accessing information. The developments experienced especially in the internet and computer technologies have affected the field of education as well as every field, (Odabaş, 2003), and even education and technology have become unthinkable independently of each other (Saklan & Cezmi, 2018). It is called the integration of technology and education, in which technologies are included in education, increasing the quality of education and training processes, and producing solutions for the needs of society (Wang & Woo, 2007). It is known that the use of education and technology with the right planning makes the lessons more interesting for students (Karadağ & Bayrak, 2013), increase student success (Hew & Brush, 2007), and enriches learning processes (Jones, 2020). Technology, when used effectively, can play a role in arousing curiosity and interest and facilitating students' learning (Arnone et al., 2011). The role of teachers in the process of using technology in education is very important. Adıgüzel (2010) stated in his study that teachers do not use many educational technology tools. It is observed that teachers who use computers frequently in daily life do not use them as educational tools (Hew & Brush, 2007). To complete the process of technology integration into education, teachers also need to have the ability to successfully apply technology (Niess et al., 2009) and experience (Farjon et al., 2019), in addition to their beliefs about the importance of technology. At the same time, scholars have a great role in the integration process. It is important to teach teachers -pre-service teachers- not what technology is, but how technology should be used in education (Güntepe & Keleş, 2022).

In education processes, the book has maintained its importance as the most basic tool used by students and teachers to access information (Tekışık, 1986). Traditionally, books are tools where the interaction with the reader is low (Lebert, 2009). Therefore technological developments have been used to bring readers and books together more. In 1971, the electronic book era started with the Gutenberg Project by an entrepreneur named Michael Hart so that everyone could use the electronic versions of important works (Lebert, 2009). The first e-book was the "American Declaration of Freedom", which Hart transferred to electronic media (Thomas, 2007). E-Books are books that provide readers with access to the content of any book in electronic form (Rukancı & Anameric, 2003). Today, with the

widespread use of mobile devices and the increase in internet speed, the contents are presented in a more visual, effective, and attractive way (Gümüş et al., 2012). With the increase in touch phones and computers, content designs are made that differentiate the usage. Thus, while e-books only provide ease of transport, educational content is transmitted more effectively with the use of interactive or enriched books (Özer & Türel, 2015). While these contents are pronounced as Z-Books in Turkey, they are referred to as Interactive e-books in international publications (Hwang et al,, 2016). In some sources, it is referred to as a multimedia e-book (Annamalai, 2016). Interaction is defined as two or more people communicating with each other (Cambridge, 2014). According to Garrison (1990), increasing interaction enables learners to exhibit positive attitudes in the learning process and increases their success. In the use of Interactive e-books, the user is active and a rich mutual communication process occurs (Itzkovitch, 2012). This situation makes learning permanent and increases student success (Guzeller & Korkmaz, 2007). Öçal and Şimşek (2017) stated interactive e-books were an important educational material due to the increase of visuality in mathematics education and the fact that they are abundant question-solving tools.

Problem Status

When technology is used effectively, it can play an important role in arousing curiosity and interest and in facilitating students' participation in learning (Arnone et al., 2011). E-learning offered by technology and the use of digital platforms during training differs from traditional education methods (Alur et al., 2002). There are many ways to use technology for interactive e-books (Wu et al., 2018). In the modern curriculum, interactive e-book technology makes a useful addition to traditional methods (Sinclair et al., 2015; Stirling & Birt, 2014). Smart boards, which are used in classrooms, especially in developed countries are at the top of the technological tools used by teachers (Sünkür et al., 2012). In the literature, there are many studies stating that smart boards are useful and beneficial (Daghan et al., 2015; Gadbois & Haverstock, 2012). However, there is a need to explore new interactive technological developments such as interactive e-books and e-contents that will increase the use of smart boards (Barate et al., 2014). In this context, interactive e-book development has an important place in this field. In education, it is possible to use electronic books and interactive e-books to improve the teaching processes of students (Bozkurt, 2015). In the determination of these processes, firstly it is necessary to determine the cognitive, affective, and behavioral reactions of the students. Accordingly, the problem sentence of the research was formed as "What is the relationship between the variables affecting the secondary school students' use of interactive e-books as a digital learning resource?"

On the other hand, the sub-problems were determined as follows,

- ✓ Sub-problem 1: What is the scope validity of the scale developed according to the TAM model for the acceptance of secondary school students towards interactive e-books as a digital learning resource?

✓ Sub-problem 2: What is the construct validity of the scale developed according to the TAM model for the acceptance of secondary school students towards interactive e-books as a digital learning resource?

✓ Sub-problem 3: How do the variables in the scale develop according to the TAM model for secondary school students' acceptance towards interactive e-books as digital learning resources interact with each other?

✓ Sub-problem 4: Is the scale developed according to the TAM model for secondary school students' acceptance towards interactive e-books as a digital learning resource valid and reliable?

Importance and purpose of the research

Today, developments in software and hardware have brought the integration of technology into the learning process in the classroom. It has been emphasized in studies that learning will be more effective if it is possible to use technology in learning processes (Aktaş et al., 2014; Korkmaz & Çakıl, 2013). The use of interactive e-books instead of traditional textbooks is a method of using technology in education. Examining students' curiosity, attitudes, and behaviors in learning processes using interactive e-books can provide important information to the literature. In this context, the acceptance processes for the use of interactive e-books were examined according to the TAM. This research is important in terms of developing a measurement tool regarding the interactive book use attitudes of secondary school students, which are not included in the literature, thus enabling new studies. Therefore, This research aims to determine the attitudes, behaviors, and intentions of secondary school students towards the interactive e-book tool used in their lessons, as well as to offer suggestions through interpretations according to the results.

To fulfill this purpose, TAM was used to determine the cognitive, affective, and behavioral responses of secondary school students while using interactive e-book tools in lessons. TAM is widely used to examine individuals' technology acceptance processes. TAM consists of key variables such as acceptance to use, including perceived ease of use, perceived usefulness, and behavioral intention (Davis, 1989).

Methodology

This research is based on the exploratory sequential mixed research method, in which quantitative and qualitative studies are used together, and continue the attitudes and behaviors of secondary school students towards the interactive e-book tools that their teachers use in their lessons (Raturi & Jack, 2006). The exploratory sequential mixed method design begins with a phase that includes the collection and analysis of qualitative data. In the qualitative part, various methods can be used, including case studies or thematic content analysis (Cresswell & Clark, 2017). Specifically, at this stage, the results of the qualitative components can be used to develop the creation of the quantitative

component. Qualitative data are analyzed by partially converting them to quantitative data (Curry & Nunez-Smith, 2016). Based on this context, focus group interviews were conducted with a group of secondary school students to first create an item pool. As a result of the focus group discussions, the opinions of the secondary students regarding the interactive e-book concepts, which characterize their attitudes, behaviors, and intentions, were noted and contributed to the creation of the items. Literature data were also used to increase the number of items. Then expert opinion was sought to determine the extent (content validity) of the items in the scale to serve as the measurement tool to reach the target (Tekin, 1977). The factor analysis method was used to ensure the construct validity of the items to be used in the study. Finally, the structural validity of the draft IE-BAS, exploratory and confirmatory factor analysis, was provided. The relations between the variables were determined with the structural equality model.

The Steps of Scale Development

This study aims to develop a valid and reliable measure tool that will serve to measure the attitudes, behaviors, and intentions of secondary school students toward the interactive e-book tool. The data used in the research were collected from a total of 285 5th, 6th, 7th, and 8th-grade students studying at a public school in a city in the west of Turkey. In the research methodology, the following stages are given in Table 1 under sub-headings.

Table 1. The Steps of Scale Development

Study	Pathway	Stage	Process
Study 1	Content Validity (Subproblem 1)	Stage 1	Items were collected from the TAM literature and through focus group interviews. The draft IE-BAS was created with 39 items and its content validity was ensured by expert opinions.
		Stage 2	The CVR and CVI values of each item in the form were calculated as a result of the opinions of the experts. Items numbered 7-13-25-30 were removed from the draft IE-BAS. Face validity was also provided with a group of secondary school students.
	Construct validity (Subproblem 2)	Stage 3	The construct validity of the form was provided by EFA. It was made on the data obtained from 285 secondary school students. items 13 and 35 were removed from the draft interactive e-book scale
	Confirmation of construct validity (Subproblem 2)	Stage 4	The confirmation cross-validity of the IE-BAS was performed on the data from 285 secondary school students. These data were obtained from the same sample from the sample group used in the pilot application. Items 2, 3, 6, 15, 16, 18, 19, 20, 23, 24, 27, 28, and 34 which could not meet the construct validity assumptions, were removed from the IE-BAS. Convergent and discriminant validity was also ensured.
	Modeling (Subproblem 3)	Stage 5	The hypotheses were checked according to TAM and the data-model fit was tested
Study 2	Reliability (Subproblem 4)	Stage 6	Cronbach's Alpha coefficient was computed for each sub-factor and overall, the scale.

Control of items (Subproblem 4)	Stage 7	Anova Tukey's Nonadditivity analysis was carried out to check their relationship with each other and the homogeneity of the items constituting the IE-BAS. Whether the phenomenon can be measured appropriately with the measurement tool was determined by Hotelling's T-Squared analysis. The reliability of the independent rater in the measurement was performed by Intraclass correlation coefficient
Result	Stage 8	A valid and reliable IE-BAS was prepared. The IE-BAScontained 20 productive Likert-type items (Appendix A)

Data Collection Process for EFA

This study includes secondary school students' acceptance toward the interactive e-book. To start the study, firstly, the publications on interactive e-books in the literature were examined. However, a measurement tool whose validity and reliability have been proven could not be obtained in the literature. For this reason, the draft IE-BAS was developed to determine the behaviors, intentions, and attitudes of secondary school students toward the interactive e-book. In the development of the scale, studies on interactive e-books from the literature were examined, and then items that could be acceptance expressions were added to the measurement tool IE-BAS. A group of secondary school students was also asked to write an essay on interactive e-books. Appropriate items that could be acceptances expressions in compositions were arranged and included in the draft IE-BAS. The compliance of the items added to the draft IE-BAS with TAM was checked. TAM is a dynamic model that changes depending on the cause of beliefs, intentions, and behaviors (Sun & Zhang, 2006). In this context, phenomena that can affect behavior are modeled within the scope of technology use. These variables were cognitive responses (variables: perceived usefulness, PU and perceived ease of use, PEU), affective responses (variable: user attitude, UA), and behavioral responses (variable: behavioral intention, BI). An item pool consisting of 39 Likert-type acceptance expressions was created. The draft IE-BAS of 39 items was presented to the expert group, and content validity was evaluated psychometrically. IE-BAS was applied to a group of 285 students for a pilot study after expert opinions.

Demographic profile of the respondents for EFA

The community in which the results of scientific research are interpreted is called the universe (Büyüköztürk et al., 2012). In this context, the universe of the research consists of 3240 secondary school students studying in the Ezine district of Çanakkale, Turkey in the 2021-2022 academic year. The sample of the research from the universe consisted of 285 students determined by the simple random sampling method (Altunışık et al., 2005). In determining the sample size from the universe, the equation proposed by Yamane (2001) is used. With the so-called equation, the sample number was obtained as 140. However, 285 secondary school students were included in the study. Accordingly, 153 (53.7%) of the 251 secondary school students participating in the study were girls and 132 (46.3%) were boys. Of the students in the study, 67 (23.5%) were 5th graders, 90 (31.5%) 6th graders, 64 (22.5%) 7th graders, and 64 (22.5%) 8th graders. In the research, students were asked how many courses they

used the interactive e-book technology. The answers of the students were coded as 1-2, 3-4, and 5-6. In the research, 37 (13%) students selected options 1-2, 168 (59%) students selected options 3-4, and 80 (28%) students selected options 5-6. In addition to these data, students were asked how many days a week their teachers benefit from interactive e-book technology. In this context, 9 (0.3%)students stated that their teachers did not use any interactive books per week. In addition, 7 (0.25%) students stated that their teachers use interactive books once a week, 13 (0.45%) students twice times a week, 61 (21.4%) students three times a week, 53 (18.5%) students four times a week, and 142 (%50) students every day a week.

Results

Overview of Statistical Analyses

Statistical analyzes of the study were carried out in four main stages. In the first stage, the expert opinions of 14 people were taken to ensure the content validity of the draft IE-BS, which was created by using the literature and student compositions. In the second stage, EFA was performed to examine the factors in the draft IE-BS. AFA was performed by using SPSS 21.0 package program. In the third stage, the factor structures obtained in EFA were confirmed by CFA. CFA cross-validation was carried out through the Analysis of Moment Structure (AMOS) 24 program. In the last part of the study, hypotheses for the variables of the TAM model were established and their validity was examined.

Findings related to sub-problem 1

Content Validity

The indicator of whether the items in the test are sufficient in terms of quantity and quality in measuring the feature to be measured is determined by content validity (Büyüköztürk, 2007). In other words, it determines to what extent the items in the scale to be developed represent the attitude expected to be measured. Thus, it can be ensured that stronger concepts are created instead of using concepts that are unrelated to the subject (Ayre & Scally, 2014). Skills such as the language of the items to be included in the scale and the suitability of the items to the subject are determined by expert opinions. This can be achieved with the expert opinion technique. Here, to ensure content validity support was received from a team of 14 experts determined by the convenient sampling method. This expert group consisted of one language expert, one assessment and evaluation expert, four science experts working in the education faculty, and eight science teachers working in schools affiliated with the Ministry of National Education. The scoring of the feedback from the expert group was evaluated according to the recommendation of Yusoff (2019). As a result of scoring, the content validity index (CVI) and content validity ratio (CVR) were calculated. CVR is the method used to determine whether it is valid for each item and CVI is used to determine the relationship of each item to the scale (Shi et al., 2012). To ensure the content validity of the IE-BS, it was carried out with 6 steps specified by Polit and Beck (2006).

These steps are preparing the content verification form, determining a review panel, content verification, examination of areas and items, calculating scores for each item, and found of CVR, I-CVI, and S-CVI values. The CVR and CVI values are used for the rejection or acceptance of some item in scale. CVR was calculated according to the formula CVR= $\frac{A}{\frac{N}{2}} - 1$ (Ayre & Scally, 2014). Here N, and A are the total number of experts, the number of specialists who assess as relevant, that is, the number of experts who give 3-4 points, respectively. In calculating the CVR values, the critical CVR was used as CVR$_{critical}$ for each item positive at α=0.05 levels and the minimum CVR$_{critical}$ value of the item to be included in the scale should be 0.51 (Ayre and Scally, 2014). Accordingly, it was determined that items 7,13,25, and 30 could not provide the minimum CVR values. On the other hand, since the CVI expression, which was put forward by Lawshe (1975) and edited by Ayre and Scally (2014), remains an artificial approach, the calculations regarding content validity were expanded with Yusoff (2019)'s suggestion. According to this suggestion, there are two separate CVI forms. These are the item-level content validity index (I-CVI), which helps define the content index of the item, and the scale-level content validity index (S-CVI) value, which includes general content validity. Whether the experts were compatible with each other was calculated using the S-CVI value. The S-CVI value, which examines the agreement of expert opinions, can be calculated using two methods. The first of these is the I-CVI mean of all the items can be found as S-CVI/Ave. Another is the S-CVI/UA based on the experts' number who marked 3-4 to the relevance level of all the items in the scale. The S-CVI/UA is called the universal agreement index. In calculations, the I-CVI value should be at least 0.75 or greater in studies involving 5 or more experts (Lynn, 1986, Davis, 1992, Polit & Beck, 2006). Accordingly, the I-CVI values of items 7,13,25, and 30, which are considered to be used in the IE-BS scale, are lower than .75. Also, S-CVI/Ave and S-CVI/UA values should be at least .80 for the general validity of the scale (Orts-Cortés et al., 2013). Here The S-CVI/Ave and S-CVI/UA values were calculated as .93 and .84, respectively. Finally, after the calculations, the feedback scores were converted to Kappa values to eliminate the chance factor. The kappa index (k*) is a fit index indicating that the items are beyond the possibility of being subject-oriented, clear, and understandable (Wynd et al., 2003). The kappa value was evaluated by the Fleiss kappa sequence (Fleiss, 1971). Accordingly, the kappa values of items 7,13, 25, and 30 were determined lower than .48. As a result of each calculation above, items 7,13, 25, and 30 were removed from the 39-item draft measurement tool because they could not provide the CVR, I-CVI, and kappa values. Thus, a 35-item draft IE-BS was prepared in a 5-point Likert type to prove content validity. Table 2 shows the expert system for content validity of the draft IE-BAS.

Items	Experts														Score				N_A	I-CVI	UA	CVR	pc x10⁻³	k*	Rating[a]
	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14	4	3	2	1							
Item1	4	4	4	4	3	4	4	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	.061	1.00	Excellent
Item2	4	4	4	4	4	4	4	4	4	4	3	4	4	4	13	1			14	1.00	1	1.00	.061	1.00	Excellent
Item3	4	4	4	4	4	4	3	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	.061	1.00	Excellent
Item4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	.061	1.00	Excellent
Item5	4	4	4	4	4	4	4	4	3	4	4	4	4	4	13	1			14	1.00	1	1.00	.061	1.00	Excellent
Item6	4	4	4	4	4	4	4	3	4	4	4	4	2	4	12	1	1		13	.93	0	.86	.85	.93	Excellent
Item7	3	2	4	2	2	3	4	3	4	3	2	2	2	2	3	4	7		7	.50	0	.00	209	.37	Poor
Item8	4	4	4	4	4	4	3	2	4	4	4	4	4	4	12	1	1		13	.93	0	.86	.85	.93	Excellent
Item9	4	3	4	4	4	4	4	4	3	4	4	4	4	4	12	2			14	1.00	1	1.00	.061	1.00	Excellent
Item10	4	4	4	4	4	4	4	3	4	4	4	4	2	4	12	1	1		13	.93	0	.86	.85	.93	Excellent
Item11	2	4	4	4	4	4	4	4	4	3	4	4	4	4	12	1	1		13	.93	0	.86	.85	.93	Excellent
Item12	4	4	4	4	4	4	4	4	4	4	4	4	4	3	13	1			14	1.00	1	1.00	.061	1.00	Excellent
Item13	2	4	2	2	3	4	4	4	4	2	2	2	4	4	7	1	6		8	0.57	0	0.14	18,2	.48	Poor
Item14	4	4	4	4	4	3	4	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	.061	1.00	Excellent
Item15	4	4	4	4	3	4	4	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	.061	1.00	Excellent
Item16	3	4	4	4	4	4	4	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	.061	1.00	Excellent
Item17	4	4	4	4	4	4	4	4	4	4	4	4	4	3	13	1			14	1.00	1	1.00	.061	1.00	Excellent
Item18	4	4	4	4	4	4	4	3	4	4	4	4	2	4	12	1	1		13	.93	0	.86	.85	.93	Excellent
Item19	4	4	4	4	4	4	4	4	4	3	4	4	4	4	13	1			14	1.00	1	1.00	.061	1.00	Excellent
Item20	4	3	4	4	4	4	4	4	4	4	3	4	4	4	12	2			14	1.00	1	1.00	.061	1.00	Excellent
Item21	4	4	4	4	4	4	4	3	4	4	4	3	4	4	12	2			14	1,00	1	1.00	.061	1.00	Excellent
Item22	4	4	3	4	4	3	4	4	2	4	4	4	4	4	11	2	1		13	0.93	0	.86	.85	.93	Excellent
Item23	4	3	4	4	4	4	4	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	.061	1.00	Excellent
Item24	4	3	4	4	4	4	4	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	.061	1.00	Excellent
Item25	2	2	2	3	2	3	4	4	3	2	2	4	2	3	3	4	7		7	0.50	0	.00	209	.37	Poor
Item26	4	4	3	4	4	4	4	4	4	3	4	4	4	4	13	1			14	1.00	1	1.00	.061	1.00	Excellent
Item27	4	4	4	2	4	4	4	4	4	4	4	2	4	3	11	1	2		12	.86	0	.71	5,55	.86	Excellent
Item28	4	4	4	4	3	4	4	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	.061	1.00	Excellent
Item29	4	4	4	4	4	4	3	4	4	4	4	4	4	4	13	1			14	1.00	1	1.00	.061	1.00	Excellent
Item30	2	4	2	2	3	4	4	4	4	2	2	2	4	4	7	1	6		8	.57	0	.14	18,2	.48	Poor

Item31	4	4	4	4	4	3	4	4	4	3	4	4	4	4	12	2		14	1.00	1	1.00	.061	1.00	Excellent
Item32	4	4	4	4	4	4	4	4	4	4	4	3	3	4	12	2		14	1.00	1	1.00	.061	1.00	Excellent
Item33	4	4	3	4	4	4	4	4	4	4	4	4	4	3	12	2		14	1.00	1	1.00	.061	1.00	Excellent
Item34	4	3	4	4	4	4	4	4	4	3	4	3	4	4	11	3		14	1.00	1	1.00	.061	1.00	Excellent
Item35	4	4	3	4	4	4	4	4	4	4	4	4	4	4	13	1		14	1.00	1	1.00	.061	1.00	Excellent
Item36	4	4	4	4	3	2	4	4	4	4	4	3	4	4	11	2	1	13	.93	0	.86	.85	.93	Excellent
Item37	4	4	3	4	4	4	3	4	4	4	4	4	4	4	12	2		14	1.00	1	1.00	.061	1.00	Excellent
Item38	4	4	4	4	3	4	4	4	4	4	4	4	4	3	12	2		14	1.00	1	1.00	.061	1.00	Excellent
Item39	4	4	4	3	4	4	4	4	4	4	4	4	4	4	13	1		14	1.00	1	1.00	.061	1.00	Excellent
Relavance	.94	.91	.91	.89	.96	.98	1.0	.93	.93	.91	.91	.91	.98	.95				S-CVI/UA		.84				

The average rate of items evaluated as relevant by 14 experts after removing 4 items, S-CVI/Ave*	.93

NA: Number of Agreement; According to Ayre and Scally (2014), there is no item below the CVR=$CVR_{critical}$ value (.571); I-CVI: Item content validity; Pc: the probability of random compromise; k^*: kappa coefficient; Evaluation criteria of k^*: poor ≤.39, weak = .40-.59; good = .60-.73; excellent ≥.74 according to Fleiss (1971), S-CVI/Ave* (based on proportion relevance): average proportion of "relevant" scores through experts index; S-CVI/Ave (based on I-CVI): average I-CVI scores of all items

Face Validity

After the content validity, face validity was performed to examine the simplicity of the language of the form and the clarity of the structure (Yusoff, 2019). The 35-item draft IE-BAS which ensured the content validity was presented to a panel group of 30 secondary school students (Hadie et al., 2017; Yusoff, 2019). The suggestions in the form were evaluated as follows

✓ the item is not clear (1 point)

✓ the item is somewhat clear (2 points)

✓ the item is clear enough (3 points)

✓ and the item is very clear (4 points)

In addition, it was also asked whether the substance required to change or not. The item-level face validity index (I-FVI), scale-level face validity index based on the average method (S-FVI/Ave), and scale-level face validity index based on the universal agreement method (S-FVI/UA) were calculated for face validity. The above-mentioned I-FVI value is the ratio of respondents giving 3-4 points to all respondents in the evaluation of the clarity of an item. The S-FVI/Ave value is also the average of the I-FVI value of all the items in the form. And the S-FVI/UA value is the ratio of respondents who give 3-4 points to the clarity of an item in the whole form. If all experts have agreed on an item, the UA (universal agreement) value is 1. The minimum acceptable values for I-FVI and S-FVI are .8 and .83. All calculations and determinations regarding face validity were carried out in line with the recommendations of Ozair (2017). I-FVI, S-FVI, S-FVI/Ave, and S-FVI/UA values were obtained as .91, .91, .93, and .83, respectively. Since there was no item eliminated as a result of face validity, a comparative table was not included.

Findings related to sub-problem 2
Construct Validity

After providing content validity, normality analyzes were performed to verify the structural validity of the 35-item draft IE-BS. In this study, it was decided whether the data conformed to the normal distribution, by using the skewness and kurtosis statistics, which are descriptive analysis methods. In normality tests, skewness and kurtosis values should be between -2 and +2 (George & Mallery, 2010). When these conditions are met in the scale, the data are considered to have a normal distribution. After the pilot application with 285 secondary school students over 35 items, the skewness coefficient was calculated as $-.507 \pm .144$, while the kurtosis coefficient was calculated as $.793 \pm .288$.

Factor Load Analysis

In the study, Kaiser-Meyer-Olkin (KMO) sample adequacy test and Barlett Sphericity Test regarding the items in the draft IE-BAS were conducted to measure the conformity of the expressions to the factor analysis. The result of the Barlett Test of Sphericity was positive ($\chi2=4374.859$, df=528,

p<0.01), and the KMO coefficient was calculated as .925. The fact that the KMO value is above .9 also determines the sample adequacy as perfect (Leech et al., 2005). With these results, it is seen that the data set for EFA is perfect. Maximum Likelihood Estimation (MLE) was used in the provision of EFA as it is parallel to the CFA. Varimax was used for rotation and the Listwise Selection method was used for the removal of missing data.

Table 3. Results of EFA for the 35-item draft IE-BAS

Code	Items	Factor Loading				Com*	Eigen Value	Cumulative %
		PEU	PU	UA	BI			
PEU	item1	.791				.687		
	item10	.743				.674		
	item11	.727				.646		
	item2	.712				.541		
	item3	.708				.531	10.81	32.78
	item12	.663				.605		
	item9	.628				.578		
	item17	.621				.506		
	item22	.619				.577		
	item19	.613				.525		
PU	item30		.702			.598		
	Item21		.671			.491		
	item27		.652			.480		
	item31		.641			.494		
	item26		.627			.548	2.32	39.83
	item25		.625			.510		
	item29		.586			.430		
	item20		.496			.446		
	item28		.488			.330		
	Item34		.462			.350		
UA	item8			.735		.589		
	item7			.726		.602		
	item5			.698		.520		
	item4			.674		.555		
	item16			.579		.510	2.25	46.67
	item23			.573		.411		
	item18			.516		.394		
	item6			.478		.360		
	item24			.463		.345		
BI	Item32				.810	.683		
	Item14				.792	.697	2.06	52.94
	Item33				.746	.660		
	Item15				.727	.594		

Com*: Communalities; Total variance explained: 52.94 %

In EFA, the lower limit of the common factor variances of the items was determined as .40 (Büyüköztürk, 2007). Accordingly, it was observed that the factor load values of items 13 and 35

remained below .40. It is therefore eliminated from the draft IE-BAS. As seen in Table 3, EFA showed that the total variance explained by the draft IE-BAS, which was collected in 33 items and 4 factors, was 52.94%. The items in the first sub-dimension of the draft IE-BAS are related to the ease of using interactive e-books and refer to the PEU variable according to TAM. There are 10 items in the PEU sub-dimension of the draft IE-BAS and the factor loading values of the items vary between .613 and .791. The amount of variance explained by this factor alone is 32.78 %. The second sub-dimension of the draft IE-BAS includes items related to the belief that the use of interactive e-books will increase learning. This sub-dimension refers to the PU variable according to TAM. There are 10 items in this sub-dimension and the factor loading values of the items vary between .462 and .702. The amount of variance explained by this factor alone is 7.05 %. The third sub-dimension of the draft IE-BAS includes items showing positive or negative attitudes towards the use of interactive e-books. This sub-dimension refers to the UA variable according to TAM. There are 10 items in the UA sub-dimension and the factor loading values of the items vary between .463 and .735. The amount of variance explained by this factor alone is 6.84%. The last sub-dimension of the draft IE-BAS includes items expressing students' behavioral intentions towards interactive e-book use. This refers to the BI variable according to TAM. There are four items in the BI sub-dimension and the factor loading values of the items vary between .727 and .810. The amount of variance explained by this factor alone is 6.26 %.

Confirmatory Factor Analysis

In this study, data from the sample group participating in EFA were used for CFA. Actually, for CFA and EFA analysis the different sample groups randomly selected from the same population are ideal but in the current situation, it was not possible. However, this limitation does not significantly detract from the results found in the current study (Sema et al., 2020). In calculations, it was checked whether there was missing data for each item and the most repeated option in that series was placed instead of the missing variable. CFA tests whether the proposed construct is validated as a model. In CFA it is also determined whether the determined theoretical structure exists in the data. Accordingly, the compatibility of the four-factor structure with the sample data was investigated using the AMOS 24.0 program to confirm the EFA results.

First-Level Confirmatory Factor Analysis

The first level of CFA incorporates the relationship between the factors that have been in the proposed model. The path diagram of the CFA obtained from the analysis of the data-model fit is given in Figures 1 and 2.
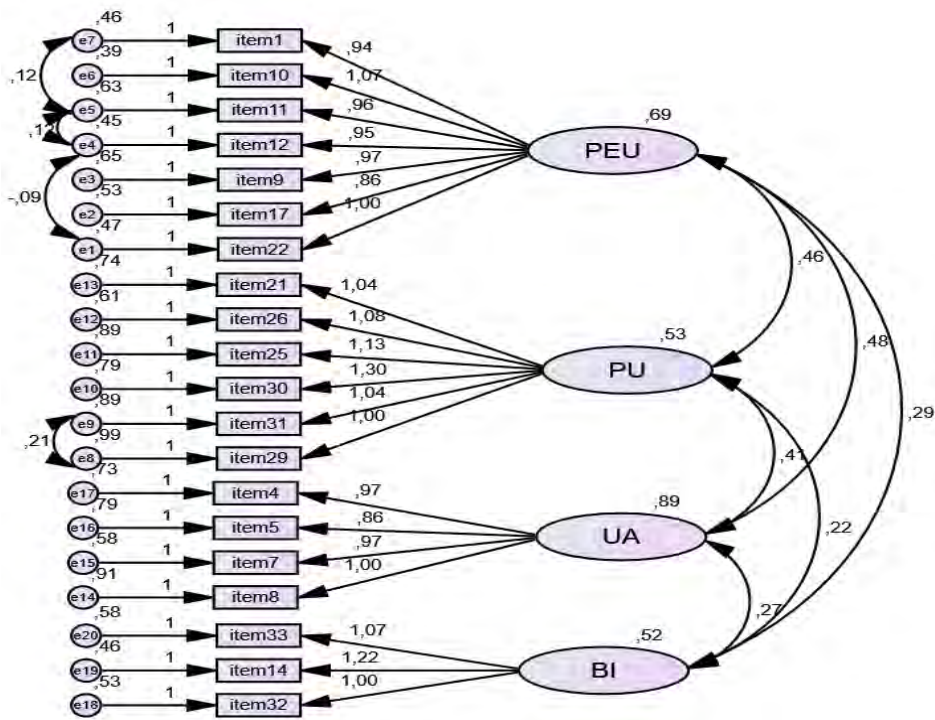
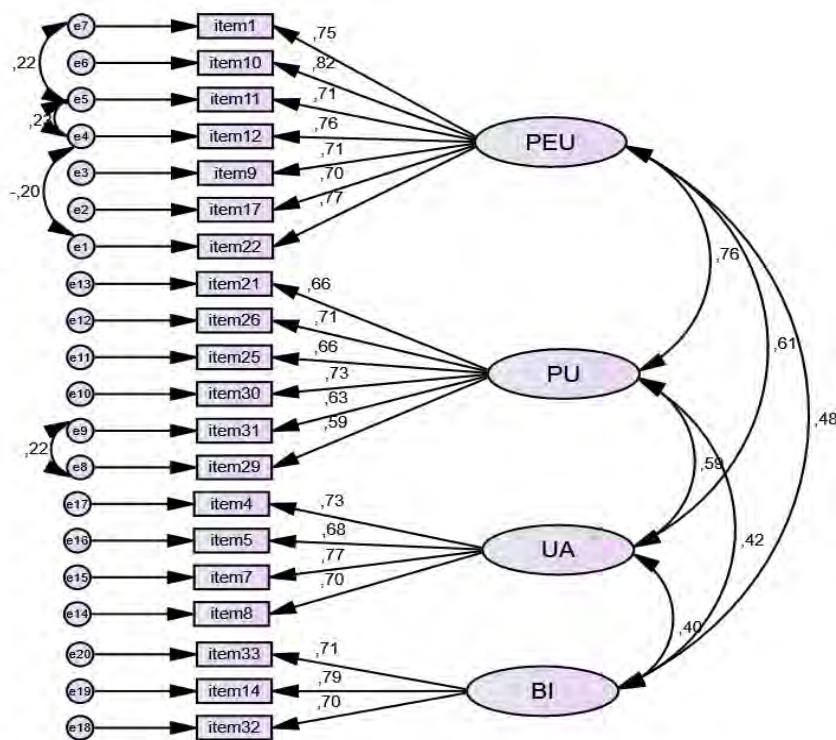**Figure 1. Unstandardized factor loads in the path diagram of IE-BTS**

Figure 2. Standardized factor loads in the path diagram of IE-BTS

After the analysis, it was observed that there were 7 items in the PEU, 6 items in the PU, 4 items in the UA, and 3 items in the BI. Accordingly, thirteen items (items 2, 3, 6, 15, 16, 18, 19, 20, 23, 24, 27, 28, and 34) in the CFA analyses with low factor loading values were removed from the IE-BAS. Path

coefficients of the remaining items were found to be statistically significant. Considering the standardized path coefficients, it was found that the item with the highest effect on PU was item 30, the item with the highest effect on PEU was item 10, the item with the highest effect on BI was item 14 and the item with the highest effect on UA was item 7. CFA provides information on the level at which each item in the IE-BS represents its latent variable (Bayram, 2010). Table 4 shows all standardized values obtained from the first-level diagram provided using the MLE.

Table 4 First-level confirmatory factor analysis for all sub-dimensions of IE-BAS

Items		Latent Variable	β_0	B_1	S.E.	C.R.	P
item22	<---	PEU	.771	1			
item17	<---	PEU	.698	.859	.071	12.057	<.001
item9	<---	PEU	.707	.973	.081	12.026	<.001
item12	<---	PEU	.763	.953	.079	12.097	<.001
item11	<---	PEU	.709	.959	.081	11.896	<.001
item10	<---	PEU	.816	1.067	.075	14.149	<.001
item1	<---	PEU	.751	.935	.073	12.871	
item29	<---	PU	.592	1			<.001
item31	<---	PU	.629	1.044	.111	9.425	<.001
item30	<---	PU	.73	1.3	.141	9.191	<.001
item25	<---	PU	.657	1.126	.133	8.488	<.001
item26	<---	PU	.711	1.08	.12	9.009	
item21	<---	PU	.66	1.037	.122	8.52	<.001
item8	<---	UA	.703	1			<.001
item7	<---	UA	.768	.967	.087	11.097	<.001
item5	<---	UA	.676	.862	.088	9.837	<.001
item4	<---	UA	.731	.97	.093	10.442	
item32	<---	BI	.704	1			<.001
item14	<---	BI	.79	1.218	.124	9.836	<.001
item33	<---	BI	.711	1.066	.109	9.765	<.001

β_0: standard covarians values, β_1: non-standardized covarians values, SE: Standard error, *p < .001 significant level

According to Table 4, all standardized factor loadings were found to be quite high. From this point of view, it can be said that all statistics are within the limits of the model at an acceptable level. As a result of CFA, the Cmin /df value of the 20-item and 4-factor scale was found to be 1.534 (C$_{min}$: 245.507 df:160, p<.05). According to Kline (2011) the proposed model is excellent if the C$_{min}$ /df value is below 2, and if the result is below 5, it is at an acceptable level. In addition, to determine the degree of fit between the model and data, other goodness-of-fit indices such as the Normed Fit Index (NFI ≥ .95, good; Bentler and Bonett, 1980), Comparative Fit Index (CFI≥.97, good; Hooper et al., 2008), Goodness of Fit Index (GFI≥.90, acceptable; Schermelleh-Engel and Moosbrugger, 2003), Adjusted

Goodness of Fit Index (AGFI ≥ .90, good; Schermelleh-Engel and Moosbrugger, 2003), Relative Fit Index (RFI≥.90, good; Schermelleh-Engel and Moosbrugger, 2003), Root Mean Square Error of Approximation (RMSEA ≤.005, good; Hooper et al., 2008, Browne and Cudeck, 1993), Standardized Root Mean Square Residual (SRMR ≤ .005, good; Schermelleh-Engel and Moosbrugger, 2003) were also examined. Accordingly, the RMSEA, SRMR, GFI, AGFI, NFI, CFI, and RFI value was found to be .043, .058, .924, .901, .909, .966, and .892, respectively. These values supported the proposed four-factor model theoretically and statistically.

Convergent and Discriminant Validity

According to the TAM, which was created for the research, the first level confirmatory analysis was carried out to reveal the interrelationships between the variables. Accordingly, the correlation values between the UA, PU, PEU, and BI variables were found to be acceptable and significant. According to the definition of Fornell and Larcker (1981), convergent and discriminant validity is carried out to determine whether the observed variables are part of the latent constructs. Here, discriminant validity indicates whether the observed variables measure the latent variable, and convergent validity indicates the relationship between the observed variables and the latent variable (Hair et al., 2010). For convergent validity, CR>.70, AVE>.50, and CR>AVE are required. To ensure discriminant validity, MSV<AVE and ASV<AVE are required. In addition, the square root of the AVE value should be greater than the correlation between variables (Hu & Bentler, 1999).

Table 5. Composite reliability and explained mean-variance values of the variables

	CR	AVE	MSV	ASV	MaxR (H)	UA	PU	PEU	BI	Cronbach's Alpha
UA	.811	.518	.369	.300	.814	0.719[a]				.810
PU	.825	.576	.530	.369	.830	.592	.728[a]			.829
PEU	.897	.586	.556	.391	.901	.608	.759	.765[a]		.899
BI	.836	.749	.229	.188	.841	.396	.425	.479	.865[a]	.779

CR: Composite reliability, AVE: *Average shared variance*, MSV: *Maximum shared variance*, ASV: Average shared variance, Note: Diagonal values (a) are the square roots of AVE values

When Table 5 is examined, it is seen that the lowest calculated AVE value for latent variables is .518 and the lowest calculated CR value is .811. According to these results, it means convergent validity is provided for all latent variables in the measurement model. It was seen that the MSV and ASV values were smaller than the AVE value for the determination of the discriminant, and the discriminant validity was provided for all latent variables when the square roots of the AVE values and the correlations between the variables were examined. In the analysis results, it is seen that the MSV and ASV values are lower than the AVE value. As a result, the values in Table 5 are sufficient and acceptable.

Findings related to sub-problem 3

Testing the Structural Model

SEM, which is used in many field studies, is a hybrid model that can perform factor analysis and regression analysis (Dow et al., 2008). SEM is used when determining the construct validity of a data set and checking the hypotheses developed for the relations between variables (Tabachnick & Fidell, 2014). It analyzes the conformity of the estimated covariance matrix created according to the theoretical model to the covariance matrix of the observed data (Hox & Bechger, 1995). Many fit statistics test the fit of the models. Fit statistics analyze the suitability of the values of the proposed models and the statistical results obtained from the sample data. If the model is not compatible with the data, the model is rejected, and if the model cannot be rejected, it can explain the causal structure underlying the observed data. In this section, to examine the reflections of secondary school students' attitudes towards the use of interactive e-book technology as a learning tool in education, the relationship between the variables was tried to be revealed within the scope of TAM. In short, the effects of PEU on PU and UA, the effects of PU on UA, and the effects of UA on BI were examined. The process performed here forms the basis of the TAM model. In the analysis, observed variables and path coefficients were used to test the mutual effects. A standardized and non-standardized path coefficient diagram of IE-BAS is given in Figures 3 and 4.
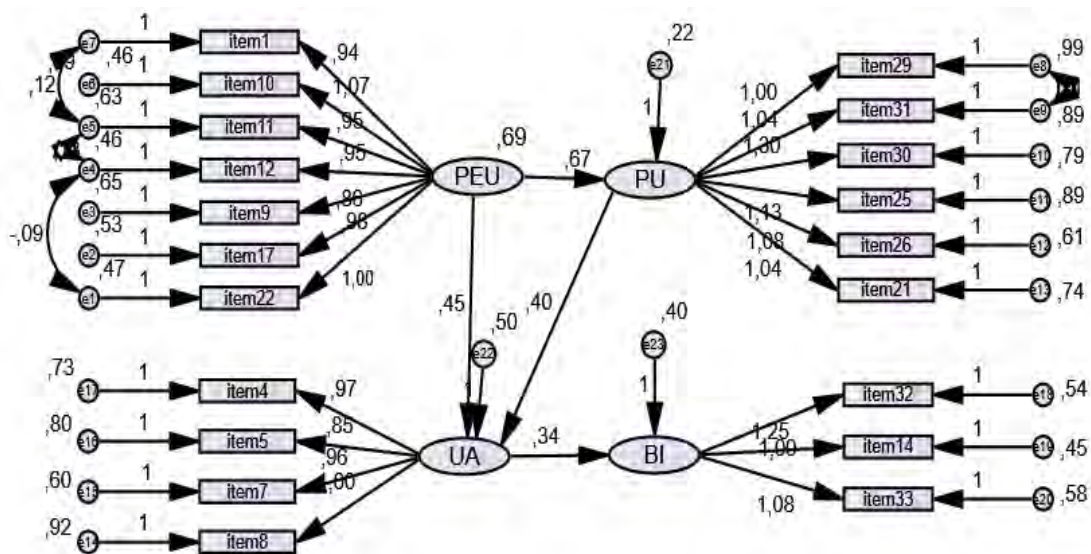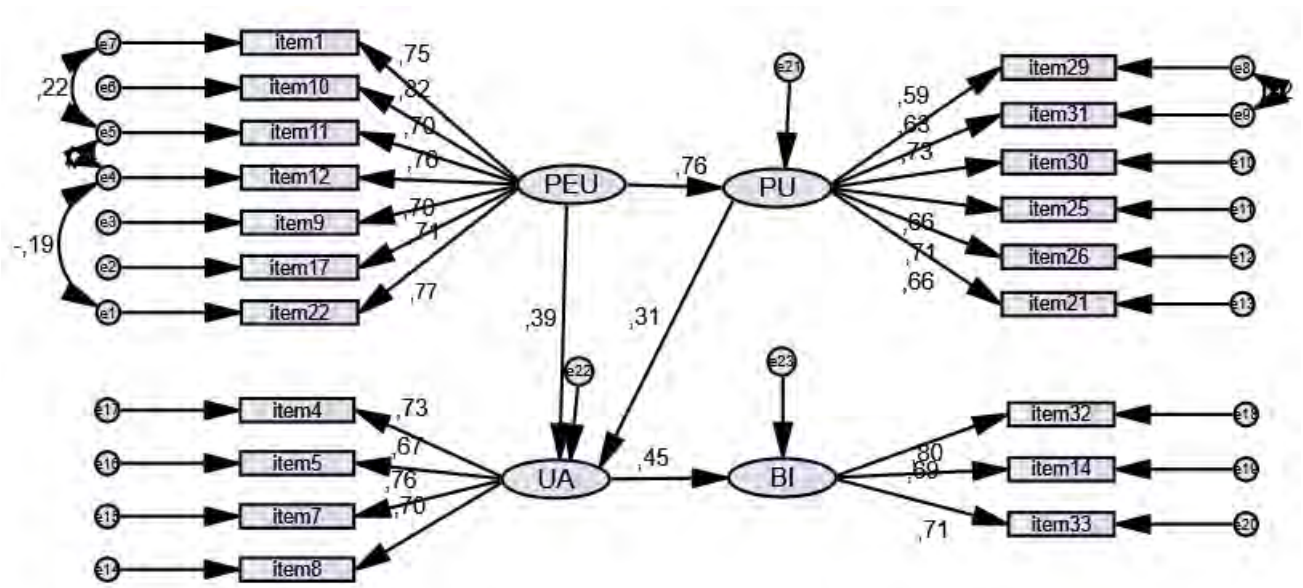

Figure 3: Non-standardized path diagram of İnteractive E-Book Scale

Figure 4: Standardized path diagram of İnteractive E-Book Scale

The RMSEA, SRMR, GFI, AGFI, NFI, and CFI values from the fit index as a result of SEM analysis were determined as .047, .077, .919, .912, .902, and .959, respectively. These values confirmed the 4-factor proposed structure and showed that the effect of each variable on the other was at an acceptable level and statistically significant. Also, Table 6 exhibited the model and the data within the model have a good fit. Table 6 shows a standardized and non-standardized path coefficient diagram of IE-BAS

Table 6 SEM analysis results for IE-BAS

Items		Latent Variable	B_0	B_1	SH	CR	p
PU	<---	PEU	.76	.668	.08	8.391	<.001
UA	<---	PEU	.394	.449	.123	3.65	<.001
UA	<---	PU	.312	.403	.147	2.753	<.001
BI	<---	UA	.445	.335	.06	5.581	<.001
item22	<---	PEU	.77	1			
item17	<---	PEU	.697	.859	.071	12.02	<.001
item9	<---	PEU	.71	.978	.081	12.051	<.001
item12	<---	PEU	.759	.95	.079	12.05	<.001
item11	<---	PEU	.704	.954	.081	11.804	<.001
item10	<---	PEU	.818	1.072	.076	14.154	<.001
item1	<---	PEU	.752	.937	.073	12.86	<.001
item29	<---	PU	.591	1			
item31	<---	PU	.628	1.044	.111	9.417	<.001
item30	<---	PU	.73	1.301	.142	9.179	<.001
item25	<---	PU	.656	1.127	.133	8.476	<.001
item26	<---	PU	.711	1,082	.12	9.003	<.001
item21	<---	PU	.661	1.039	.122	8.519	<.001

item8	<---	UA	.701	1			
item7	<---	UA	.76	.96	.087	11.09	<.001
item5	<---	UA	.668	.854	.087	9.79	<.001
item4	<---	UA	.731	.971	.093	10.49	<.001
item32	<---	BI	694	1			
item14	<---	BI	.799	1.251	0.131	9.567	<.001
item33	<---	BI	.71	1.08	0.112	9.685	<.001

β_0: standard covarians values, β_1: non-standardized covarians values, SE: Standard error, *p < .001 significant level

According to the results obtained in the created structural model, it was determined that the model was compatible and the model fit indices remained within the determined limits. In addition, it was determined that all standardized and non-standardized path coefficients were positive and significant.

Findings related to sub-problem 4

Reliability analyzes

Reliability analysis is a statistical analysis technique used to evaluate the internal consistency of the scale over the correlations of scale items in measurement tool development studies. Within the scope of reliability analysis, many different approaches are used, such as the Cronbach Alpha coefficient and the Gutman coefficients technique. By performing an internal consistency analysis, it can be determined how much the scale to be developed measured the situation it wanted to measure. A reliable scale should give similar results in similar situations. Accordingly, the reliability analysis of IE-BAS was determined using separate statistical methods.

Item Analyses

Cronbach's alpha statistic provides a general coefficient of reliability for a range of variables. For this reason, the internal validity of the IE-BAS form obtained from the study of construct validity was tested with Cronbach's alpha statistic. According to this statistic, it was seen that none of the items had an item-total correlation value below .3. Cronbach's alpha coefficient for 20 items IE-BS was found to be .914. Table 7 shows the item-total statistics of the draft IE-BAS.

Tablo 7. Item-total statistics for IE-BTS

Item	Scale means if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's Alpha if the item deleted
item1	73.5649	183.233	.622	.908
item4	73.8421	180.697	.576	.909
item5	73.9123	185.179	.459	.912
item7	73.8526	182.182	.562	.910
item8	74.0386	181.784	.499	.911

item9	74.0105	180.954	.632	.908
item10	73.6947	180.487	.687	.907
item11	73.7965	181.275	.634	.908
item12	73.7439	181.480	.684	.907
item14	73.8035	186.496	.460	.912
item17	73.8211	183.577	.617	.908
item21	73.9439	181.962	.595	.909
item22	73.7860	180.669	.687	.907
item25	73.8737	181.245	.561	.910
item26	73.9053	183.023	.581	.909
item29	74.2246	183.083	.512	.911
item30	74.1719	179.305	.595	.909
item31	74.0912	182.435	.544	.910
item32	73.8351	189.110	.410	.913
item33	73.8211	189.232	.380	.914

In the internal validity test of the draft IE-BAS, the differences between the item average scores of the 27% lower and 27% upper groups were examined with the independent *t-test*. Significant differences between the groups are considered an indicator of the internal validity (consistency) of the test. Data regarding the internal validity of the test are given in Table 8. When the internal validity findings in Table 8 were examined, the difference between the arithmetic mean scores of the lower group and the upper group was found to be statistically significant ($p<.01$). The results showed that 20 items IE-BAS distinguish students who have high and low acceptances towards interactive e-books and that IE-BAS has internal validity.

Table 8. Internal validity data of the IE-BAS

Groups	N	Mean ± sd	t	p
upper group (% 27)	77	4.6827 ± .19387	28.537	< .01
lower group (% 27)	77	3.0301 ± .47327		

The split-half method is based on the division into two equal parts of the data obtained from an application by a measurement tool, and here these two equal the consistency between the parts is examined. The Spearman-Brown Prophecy formula is used to find the reliability coefficient for the whole scale. If the Spearman-Brown value is greater than .70, it can be said that the internal consistency reliability is high. Table 9 shows the split-half reliability results for IE-BAS. In Table 9, Alpha values for the first and second parts were determined to be greater than .7. These results show that the items are consecutive and reliable (Berkün, 2010). Likewise, the correlation value between the forms was calculated as .740, the correlation coefficient was found to be .850 with the Guttman half Split formula, and the reliability of the two halves with the Spearman-Brown formula was determined as .850.

Table 9 The split-half reliability results for IE-BAS

Confidence Coefficients (N:20)	
Correlation Between Forms =.740	Equal Length Spearman-Brown= .850
Guttman Split-Half Coefficient = .850	Unequal Length Spearman-Brown = .850
Alfa= .865 (N:10[a]) for Part1	Alfa = .846 (N:10[b]) for Part2

[a]items: item1, item4, item5, item7, item8, item9, item10, item11, item12, item14

[b]Items: item17, item21, item22, item25, item26, item29, item30, item31, item32, item33

Friedman chi-Square test and Tukey additivity test were used for testing the consistency of the model, the additivity of the IE-BAS, and the relationship of the items with each other. The analysis of the variance table showed that the proposed model was consistent and the difference between the items in the IE-BAS was statistically significant (F=8.28, p<.05). In addition, the non-additivity property of the items in IE-BAS is not statistically significant (F=3.174 p>.05). Accordingly, IE-BAS is collectible, but between measurements there are differences. This shows that IE-BAS can be evaluated on the total score and its sub-dimensions. Table 10 shows ANOVA with Friedman's Test and Tukey's Test for Nonadditivity of IE-BAS

Table 10 ANOVA with Friedman's Test and Tukey's Test for Nonadditivity of IE-BAS

			SS	df	Ms	F	p
Between People			2864.281	284	10.085		
Within People	Between Items		136.976	19	7.209	8.280	.000
	Residual	Nonadditivity	2.762[a]	1	2.762	3.174	.075
		Balance	4695.461	5395	.870		
		Total	4698.224	5396	.871		
	Total		4835.200	5415	.893		
Total			7699.481	5699	1.351		

Grand Mean = 3.8888

[a.] Tukey's estimate of power to which observations must be raised to achieve additivity = 1.779.

KT: Sum of Squares, Ms: Mean squares, F: Friedman's chi-Square

Hotelling's T-Square analysis can determine whether the situation that is desired to be measured can be measured appropriately with a measurement tool (Özdamar, 2013). Accordingly, Hotelling's T-Square analyses were performed and the results are given in Table 11. Accordingly, the results showed that IE-BAS is an appropriate measurement tool in measuring the phenomenon to be measured (F=9.013, p<.05).

Table 11 Hotelling's T-Squared analysis results for IE-BAS

Hotelling's T-Squared	F	df1	df2	Sig
267.863	9.013	27	258	.000

The reliability of independent rates can be determined through intra-class correlation. Thus, the level of agreement between the rater of an outcome can be determined. if raters have misunderstandings or disagreements regarding rating performance, inter-rater reliability is not possible. In the measurement results the intraclass correlations showed that the reliability of the independent rater for single measures was weak (ICC=.331 p<.05) and the reliability of the independent rater for average measures was very good (ICC=.933, p<.05). The data including the ICC results of the IE-BAS are given in Table 12.

Table 12 The ICC results of IE-BAS

	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measurements	.346[a]	.307	.390	11.583	284	5396	.000
Average Measurements	.914[c]	.898	.928	11.583	284	5396	.000

Two-way mixed effects model where people effects are random and measures effects are fixed.

[a]The estimator is the same, whether the interaction effect is present or not.

[b]Type C intraclass correlation coefficients using a consistency definition. The between-measure variance is excluded from the denominator variance

[c]This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise

Finally, the reliability coefficient, which is related to how accurately the test measures the feature it wants to measure, is generally considered sufficient for a psychological test to be .70 or higher. Although many techniques are used to measure reliability, the most commonly used internal consistency method in scale development is Cronbach's Alpha (Sharma, 2016). Accordingly, Cronbach's Alpha value was checked for the internal consistency of the IE-BAS. In the study, the Cronbach Alpha value was found to be .899 for PEU, .829 for PU, .810 for UA, .810 for BI, and .914 for 20 items IE-BS. These values show that the items in the scale have high reliability and are intended to measure the same attitude. Table 13 shows Cronbach's alpha values for IE-BAS and its subdimension

Table 13 Cronbach's alpha values for PEU, PU, UA, BI and IE-BAS

Dimension	items	N of Items	Cronbach's Alpha

PEU	22, 19, 9, 10,11, 12,1	7	.899
PU	29, 30, 31, 25, 26, 21	6	.829
UA	4, 5, 7, 8	4	.810
BI	32, 14, 33	3	.779
		Overall scale	.914

Conclusion and Discussion

In the study, it was aimed to develop a valid and reliable IE-BAS as a digital learning resource for secondary school students. The variables of IE-BAS were determined according to TAM. The IE-BAS was developed in 2 stages, including the scope and structural validity studies. Accordingly, it is foreseen to increase the acceptability of interactive e-books by secondary school students and their level of conscious use. In this way, it will be possible to create a roadmap for more effective use of interactive e-books and thus to increase their use in schools as a learning environment. Thus, it was aimed to measure the interactive e-book usage acceptance of secondary school students with the help of TAM.

Findings for subproblem 1.

The content development studies of the interactive e-book attitude scale were carried out in 6 stages. There are preparing the content verification form, selecting a review panel with expert staff, performing content verification, examining the field and items, calculating the CVR, I-CVI, and S-CVI values, and the scores for each item. An item pool was created for IE-BS, primarily through a panel system of secondary school students and then through a literature review. The 39 items in the pool were classified according to the TAM model and created the draft IE-BAS. Then, a 39-item draft was presented to the expert opinions to ensure the content validity of the draft IE-BAS. In line with the scaling-scoring suggestion of Yusoff (2019), opinions were taken from 14 experts. Calculations were carried out in line with the recommendations of Ayre and Scally (2014), Lynn (1986), and Polit and Beck (2006). As a result of the scoring, 4 items with kappa values of .48 and below were excluded from the draft IE-BS. The CVI/Ave value of the remaining 35-item draft IE-BAS was .93 and the S-CVI/UA value was .84. These results showed that the content validity of the draft IE-BAS was achieved. After the content validity, face validity was performed to examine the simplicity of the language in the draft IE-BAS and the clarity of the structure (Yusoff, 2019). A 35-item draft IE-BAS was presented to a panel group of 30 secondary school students (Hadie et al., 2017; Yusoff, 2019). All calculations and determinations related to face validity were carried out in line with the recommendations of Ozair et al.

(2017). I-FVI, S-FVI, S-FVI/Ave, and S-FVI/UA values were obtained as .91, .91, .93, and .83, respectively. There was no item eliminated as a result of face validity.

Findings for subproblem 2.

After content validity studies, structural validity studies were carried out. Accordingly, EFA and CFA were used for construct validity studies. 285 secondary school students participated in the pilot study. Firstly, the normality analysis of the data was performed and it was decided whether the data conformed to the normal distribution, using skewness and kurtosis statistics among the descriptive analysis methods. The skewness and kurtosis were calculated as -.507 ± .144 and .793 ± .288, respectively. In EFA items 13 and 35 were excluded from the test because they did not meet the required conditions. EFA revealed that 33 items in the draft IE-BAS were clustered under four variables (PU, PEU, UA, BI) compared to TAM. Accordingly, EFA also showed that secondary school students gave cognitive (variables: PU, PEU), affective (variables: AU), and behavioral responses (variables: BI) towards interactive books through variables. To determine the level of agreement between the four-factor structure determined as a result of EFA and the sample data, CFA was performed by applying the MLE. As a result of the CFA analysis, the items that did not meet the necessary modification requirements were removed from the IE-BAS and the productive IE-BASwith 20 items were finalized. By CFA, it was observed that there were 7 items in the PEU, 6 items in the PU , 4 items in the UA , and 3 items in the BI . Considering the standardized path coefficients, it was found that the item with the highest effect on PU was item 30, the item with the highest effect on PEU was item 10, the item with the highest effect on BI was item 14 and the item with the highest effect on UA was item 7. It was determined that the fit indices for the model data fit were quite good.Accordingly, the RMSEA, SRMR, GFI, AGFI, NFI, CFI and RFI value was found to be .043, .058, .924, .901, .909, .966 and .892, respectively. Fit indices supported the proposed four-factor model for IE-BAS theoretically and statistically. On the other hand, in the four-factor model, the lowest calculated AVE value for latent variables is .518 and the lowest calculated CR value is .811. These results proved convergent validity is provided for all latent variables in the measurement model. However, the square roots of AVE values and correlations between variables showed that discriminant validity was confirmed for all latent variables.

Findings for subproblem 3.

Cognitive, affective, and behavioral responses of secondary school students to acceptance of their interactive books were examined based on the TAM through IE-BAS. In addition, the hypotheses created to measure the effects on each other of these responses were tested with regression analysis. Regression analysis allows predictions about future events through findings. SEM analyzes revealed the dependence of the cognitive, affective, and behavioral responses providing user acceptance on the

perceived usefulness (PU), perceived ease of use (PEU), attitude towards use (UA), and behavioral intention (BI) variables. In the research model, the intention to use interactive e-books emerges as a dependent variable. Perceived usefulness, perceived ease of use, and attitude towards use are independently included as variables. Accordingly, the attitude to use interactive e-books of secondary school students. can be predicted positively by their intention to use. Likewise, their attitudes to using can be predicted by perceived usefulness and perceived ease of use. In short, SEM showed that cognitive, affective, and behavioral responses affect students' acceptance to use interactive e-books according to the TAM. Accordingly, the behavioral intention variable is affected by the attitude towards use. On the other hand, the attitude towards use variable is affected by the perceived ease of use and perceived usefulness variables, and the perceived usefulness variable is affected by the perceived ease of use variable. These variables have significant and positive effects on each other. There are many studies supporting these interactions in the literature. Shih et al., (2013) stated that e-books make learning easier and faster than classical books. Sarı and Güven (2013) determined that e-books embodied the lesson, makes it fun and increase participation, facilitates and perpetuates learning. The use of interactive e-books in science contributes to students' understanding of the subject (Yang et al., 2012) and makes the lessons more enjoyable (Hall & Higgins, 2005), it is remarkable (Hsieh et al., 2015) and students find the e-book impressive and entertaining because of its visuality (Zhang -Kennedy & Chiasson, 2016). In addition, it was observed that students generally liked the interaction and flexibility provided by e-books (Zhang, 2005) and that their learning interests and motivations increased (Chen & Chen, 2011). Özel and Türel (2015) stated that teacher candidates have positive metaphors for e-books and that they find the use of e-books attractive. Studies show that interactive e-books are seen as an application that attracts the attention of students and teachers, is practical to use, saves time, makes the learning environment fun, and increases the desire to learn.

Findings for subproblem 4.

Analysis results related to the content and construct validity of the IE-BAS in subproblems 1 and 2 were presented. However, the relationship between the variables in IE-BAS is given in subproblem 3. In this subproblem, it is presented evidence for the reliability analyses of the IE-BAS. A reliable scale should give similar results in similar situations. therefore internal consistency should be high. The internal consistency of IE-BAS was examined using different statistical tools. Accordingly, Cronbach's Alpha coefficient for the overall IE-BAM was found to be 0.914. This value indicates that the internal consistency is quite high (Murphy & Davidshofer, 1988). Also, the differences between the average scores of the 27 % lower and 27 % upper groups were examined with the independent t-test. 27% low group-27 % upper groups results showed that the 20-item IE-BS was able to distinguish student acceptance toward interactive e-books. Also, Spearman-Brown and Guttman Split-Half reliability coefficients were obtained by a split-half test method in reliability analyses of IE-BAS examined. Accordingly, the Spearman-Brown coefficient was found to be greater than 0.7 for the first and second

parts. This indicates that the items in the IE-BAS are sequential and reliable. Also, the Guttman half Split coefficient was found to be .850. The consistency of the model, the additivity of items in the IE-BAS, and the relationship of the items with each other were tested Friedman chi-Square test and Tukey additivity test. The variance table showed that the proposed model was consistent and items can be additive. In addition, Hotelling's T-Square analysis exhibited that IE-BAS was a suitable measurement tool that can be used to measure a phenomenon. Finally, intraclass correlation coefficients revealed that independent raters were reliable according to both single and average measurements, and there was agreement among raters. From all these results, It can be said that IE-BAS is a valid and reliable measurement tool to evaluate secondary school students' acceptance towards interactive books as a digital learning environment.

Suggestions

As a result of the research, some suggestions were made to be used for educational purposes in the future.

1-Secondary school students' acceptance and motivation towards interactive e-books can be examined through the developed IE-BAS. Thus, lesson planning can be made more efficient by teachers.

2-The digital interactive e-books can be used as a digital learning resource due to access at any time through different platforms and cloud technology. This can increase students' motivation and success
 3-It was determined that students' motivation was increased by the interactive e-books with a high level of communication and interaction. For this reason, more space should be allocated to interactive e-books both in classroom activities and in the curriculum.

4-Also In determining the evaluation of interactive e-book standards and its criteria, the variables obtained according to TAM and their effects on each other can be taken into account.

Policy Implications

Today, software developments have made it necessary to integrate technology into learning environments. It is frequently emphasized in research that students' interest in technology will contribute to academic success when technology integrated into educational environments. One of the developments in technology is interactive e-books. Examining students' curiosity, attitudes and behaviors in the learning processes using interactive e-books can provide significant advances in the literature.

Conflicts of Interest

No potential conflict of interest was declared by the authors.

References

Adıgüzel, A. (2010). The status of instructional technology in the primary schools and classroom teachers' level of using these technologies. *Journal of Dicle University Ziya Gökalp Faculty of Education, 15*, 1-17.

Ajzen, I. (1985). From ıntentions to actions: A theory of planned behavior," in action control. J. Kuhl, & J. Beckmann (Dü.), *SSSP Springer Series in Social Psychology.* in Berlin: Heidelberg: Springer.

Akbaş, O., & Pektaş, H. (2011). The effects of using an interactive whiteboard on the academic achievement of university students. *Asia-Pacific Forum on Science Learning and Teaching, 12(2)*, 1-19.

Akpınar, B., & Aydın, K. (2010). Eğitimde değişim ve öğretmenlerin değişim algıları. *Education and Science, 32(144)*, 71-80. Retrieved Eylül 24, 2022, from https://en.wikipedia.org/wiki/Project_Gutenberg

Aktaş, I., Gökoğlu, S., Turgut, Y., & Karal, H. (2014). Teachers' opinions about FATIH project: Awareness, foresight and expectations. *Necatibey Education Faculty Electronic Journal of Science and Mathematics Education, 8(1)*, 257-286. doi:10.12973/nefmed.2014.8.1.a11

Altunışık, R., Coşkun, R., Bayraktaroğlu, S., & Yıldırım, E. (2012). *Research methods in social sciences: SPSS Applied (7th Edition).* Istanbul: Avcı Ofset.

Altun Yalçın, S., Kahraman, S., & Yılmaz, Z. A. (2020). Development and validation of robotic coding attitude scale. *International Journal of Education in Mathematics, Science and Technology (IJEMST), 8*(4), 342-352.

Alur, P., Fatima, K., & Joseph, R. (2002). Medical teaching websites: Do they refect the learning paradigma. *Med Teach 24(4)*, 422–424.

Annamalai, S. (2016). Implementing ARCS model to design a motivating multimedia e-book for polytechnic ESL classroom. *Journal of Telecommunication, Electronic and Computer Engineering, 8(8)*, 57-60. http://journal.utem.edu.my/index.php/jtec/article/view/1319/799 adresinden alındı

Arı, M. (n.d.). *Chamber of Electrical Engineers*. Retrieved September 2022, 24, from TMMOB Chamber of Electrical Engineers Website: http://www.emo.org.tr/ekler/f9b5ec26abebe62_ek

Arnone, M., Small, R., Chauncey, S., & McKenna, H. (2011). Curiosity, interest and engagement in technology-pervasive learning environments: A new research agenda. *Educational Technology Research and Development, 59(2)*, 181–198. doi:10.1007/s11423-011-9190-9

Ayre, C. &. Scarlly A. J. (2014). Critical values for Lawshe's content validity ratio: revisiting the original methods of calculation. *Measurement and Evaluation in Counseling and Development*, 79-86.

Bagozzi, R., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science, 16*, 74-94.

Barate, A., Ludovico, L., & Mangione, G. (2014). A new paradigm for music education: Creating active e-books through the IEEE 1599 Standard. *IEEE 14th International Conference.* Athens: Advanced Learning Technologies (ICALT).

Bentler, P., & Bonett, D. (1980). Significance tests and goodness of fit in analysis of covariance structures. *Psychological Bulletin, 88(3)*, 588-606.

Bozkurt, A. (2015). Mobile learning: a seamless learning experience anytime, anywhere. *AUAd, 1(2)*, 65-81.

Browne, M., & Cudeck, R. (1993). Alternative ways of assessing model fit. *Sage Focus Editions, 154*, 136.

Buyukozturk, S. (2009). *Handbook of data analysis for social sciences. (10th ed.).* Ankara: Pegem.

Büyüköztürk, Ş. (2007). *Manual of data analysis for social sciences.* Ankara: Pegem A Publishing.

Büyüköztürk, Ş. (2007). *Manual of data analysis for social sciences.* Ankara: Pegem Academy Publishing.

Büyüköztürk, Ş., Çakmak, E., Akgün, Ö., Karadeniz, Ş., & Demirel, F. (2012). *Scientific research methods.* Ankara: Pegem Academy.

Cambridge (Ed.). (2014, January 24). *Dictionary Cambridge.* Retrieved September 24, 2022, from http://dictionary.cambridge.org/dictionary/british/interaction?q=interaction

Chen, C., & Chen, C. (2011). The application of interactive media display technology in environmental science learning. *HCI International 2011.* Japan.

Choi, J., & Ji, Y. (2015). Investigating the importance of trust on adopting an autonomous vehicle. *International Journal of Human-Computer Interaction, 31(10)*, 692-702. doi:10.1080/10447318.2015.1070549

Curry, L., & Nunez-Smith, M. (2005). *Mixed methods in health sciences research: A practical primer.* Sage.

Dağhan, G., Kibar, P., Akkoyunlu, B., & Baskan, G. (2015). Approaches and opinions of teachers and administrators on the use of ınteractive board and tablet computers. *Turkish Journal of Computer and Mathematics Education, 6(3)*, 399-417. doi:10.16949/turcomat.42868

Davis, F. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Q. 13*, 319–340. doi:10.2307/249008

Davis, F. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Q., 13*, 319.

Dow, K., Jackson, C., Wong, J., & Leitch, R. (2008). A comparison of structural equation modeling approaches: The case of user acceptance of ınformation systems. *Journal Of Computer Information Systems (Summer).*

Emre, İ., Kaya, Z., Özdemir, T., & Kaya, O. (2011). The effects of the use of smart boards on the success of science and technology teacher candidates on the structure of the cell membrane and their attitudes towards information technologies. *6th International Advanced Technologies Symposium (IATS'11).* Elazig, Turkey.

Emron, S., & Dhindsa, H. (2010). Integration of interactive whiteboard technology to improve secondary science teaching and learning. *International Journal of Research and Engineering (IJRE), 28*, 1-24.

Farjon, D., Smith, A., & Voogt, J. (2019). Technology integration of pre-service teachers explained by attitudes and beliefs, competency, access, and experience. *Computer and Education,130*, 81-93. doi:10.1016/j.compedu.2018.11.010

Fleiss, J. L. (1971). Measuring nominal scale agreement among many raters. *Psychological bulletin*, 378.

Fornell, C., & Larcker, D. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18(1)*, 39–50.

Gadbois, S., & Haverstock, N. (2012). Middle years science teachers voice their first experiences with interactive whiteboard technology. *Canadian Journal of Science, Mathematics and Technology Education, 12(1)*, 121-135.

Garrison, R. (1990). An analysis and evaluation of audio teleconferencing to facilitate education at a distance. *The American Journal of Distance Education 4(3)*, 13-24.

George, D., & Mallery, M. (2010). *SPSS for windows step by step: A simple guide and reference, 17.0 update (10a ed.)* . Boston: Pearson.

Globisch, J., Dütschke, E., & Schleich, J. (2018). Acceptance of electric passenger cars in commercial fleets. *Transportation Research Part A: Policy and Practice 116*, 116. 122-129. doi:10.1016/j.tra.2018.06.004

Gottfried, A., Preston, K., Gottfried, A., Oliver, P., Delany, D., & Ibrahim, S. (2016). Pathways from parental stimulation of children's curiosity to high school science course accomplishments and science career interest and skill. *International Journal of Science Education, 38(12)*, 1-23. doi:10.1080/09500693.2016.1220690

Güntepe, E., & Keles, E. (2022). Evaluation of technology ıntegration process in the faculty of education by concentric circles model. *Journal of Ahi Evran University Kirsehir Education Faculty, 23(2)*, 1639-1690. doi:10.29299/kefad.863503

Güzeller, C., & Korkmaz, Ö. (2007). Evaluation of course software in computer based instruction. *Journal of Kastamonu Education 15(1)*, 155-168.

Hair, J., Black, W., Babin, B., & Anderson, R. (2010). *Multivariate Data Analysis.* N.J.: Prentice Hall.

Hall, I., & Higgins, S. (2005). Primary school students' perceptions of interactive whiteboards. *Journal of Computer assisted learning, 21(2)*, 102-117.

Hennessy, S., Deaney, R., Ruthven, K., & Winterbottom, M. (2007). Pedagogical strategies for using the interactive whiteboard to foster learner participation in school science. *Learning, Media and Technology, 32(3)*, 283-301.

Herianto, H., & Wilujeng, I. (2020). The correlation between students' curiosity and generic science skills in science learning. *Jurnal Inovasi Pendidikan IPA, 6(2)*, 237–245. doi:10.21831/ jipi.v6i2.37382

Hew, K., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: current knowledge gaps and recommendations for future research. *Educational Technology Research and Development, 55(3)*, 223-252.

Hooper, D., Coughlan, J., & Mullen, M. (2008). Structural equation modelling: Guidelines for determining model fit. *The Electronic Journal of Business Research Methods, 6(1)*, 53-60.

Hox, J., & Bechger, T. (1995). An ıntroduction to structural equation modeling. *Family Science Review, 11*.

Hsieh, Y., Hsueh, C., & Hsu, C. (2015). The effects of using interactive e-book on English learning effectiveness of different proficiency students. *International Journal of Mobile Learning and Organisation, 9(1)*, 86-99.

Hu, L.-T., & Bentler, P. (1999). Cut off criteria for fit ındexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal, 6(1)*, 1-55.

Hwang, G., Sung, H., & Chang, H. (2016). Effects of concept mapping-based interactive e-books on junior high school students' learning performance in law courses. *Interactive Learning Environments*, 1-12. doi:10.1080/10494820.2016.1224253

Itzkovitch, A. (2012). *Interactive ebook apps: the reinvention of reading and interactivity.* Retrieved September 24, 2022, from Ux Magazine, 816: http://uxmag.com/articles/interactive-ebook-apps-the-reinvention-ofreading-and-interactivity

Johnson, R., & Wichern, D. (2014). *Applied multivariate statistical analysis (Vol. 4).* New Jersey:: Prentice-Hall.

Jones, B. (2020). The experiences of elementary teachers regarding technology integration in the classroom. *Unpublished doctoral dissertation*. Minnesota: Walden University.

Karadağ, R., & Bayrak, Ö. (2013). Education of Turkish. *Adıyaman University Journal of Social Sciences Institute, 6(11)*, 269-307.

Kirbag-Zengin, F., Kirilmazkaya, G., & Keçeci, G. (2012). The effect of smart board use on success and attitude in science and technology lesson. *E-Journal of New World Sciences Academy, 7(2)*, 526-537.

Kline, R. B. (2011). *Principles and practice of structural equation modeling (3rd ed.).* New York London: The Guilford Press.

Korkmaz, O., & Çakıl, I. (2013). Teachers' difficulties about using smart boards. *Procedia Social and Behavioral Sciences, 83*, 595-599.

Lawshe, C. H. (1975). A quantitative approach to content validity. *Personnel psychology*, 536-575.

Lebert, M. (2009). A short history of e-books. *NEF, University of Toronto*.

Leech, N., Barrett, K., & Morgan, G. (2005). *SPSS for intermediate statistics, use and interpretation. (2nd ed.).* Mahwah: Lawrence Erlbaum Associates Inc.

Madden, T., Ellen, P., & Ajzen, I. (1992). A comparison of the theory of planned behavior and the theory of reasoned action. *Pers. Soc. Psychol. Bull. 18*, 3-9. doi:10.1177/0146167292181001

Marangunic, N., & Granic, A. (2015). Technology acceptance model: a literature ´ review from 1986 to 2013. *Univers. Access Inf. Soc. 14*, 81-95. doi:10.1007/ s10209-014-0348-1

Murphy, K., & Davidshofer, C. (1998). *Psychological testing: Principles and applications (4th edn.).* New Jersey: Prentice-Hall.

Niess, M., Ronau, R., Shafer, K., Driskell, S., Harper, S., Johnston, C., & Kersaint, G. (2009). Mathematics teacher TPACK standards and development model. *Contemporary Issues in Technology and Teacher Education, 9(1)*, 4-24.

Odabaş, H. (2003). Internet-based distance education and information and document management departments. *Turkish Librarianship, 17(1)*, 22-36.

Orts-Cortés, M. I., Moreno-Casbas, T., Squires, A., Fuentelsaz-Gallego, C., Maciá-Soler, L., & González-María, E. (2013). Content validity of the Spanish version of the practice environment scale of the nursing work index. *Applied Nursing Research*, 5-9.

Öçal, M., & Şimşek, M. (2017). Opinions of pre-service mathematics teachers on the FATIH project and the use of technology in mathematics education. *Turkish Online Journal of Qualitative Inquiry (TOJQI), 8(1)*, 91-121. doi:10.17569/tojqi.288857

Özdamar, K. (2010). *Biostatistics with PASW*. Eskişehir: Kaan Bookstore.

Özdamar, K. (2013). *Statistical data analysis with package programs-II, (Multivariate Methods), 9th Edition.* Eskişehir: Nisan Bookstore.

Özer, S., & Türel, Y. (2015). ICT teacher candidates' metaphoric perceptions of e-book and ınteractive e-book. *Turkish Online Journal of Qualitative Inquiry, 6(2)*, 1-23.

Pallant, J. (2007). *SPSS survival manual: A step by step guide to data analysis using SPSS for windows (3rd ed.).* Berkshire: Open University Press.

Polit, D. F., & Beck, C. T. (2006). The content validity index: are you sure you know what's being reported? Critique and recommendations. *Research in nursing & health*, 489-497.

Raturi, A., & Jack, E. (2006). Lessons learned from methodological triangulation in management research. *Management research news 29(6)*, 345-357.

Ridout, M., Demetrio, C., & Firth, D. (1999). Estimating intraclass correlation for binary data. *Biometrics, 55 (1)*, 137-148.

Rukancı, F., & Anameriç, H. (2003). E-book technology and its use. *Turkish Librarianship, 17(2)*, 147-166.

Saklan, H., & Cezmi, Ü. (2018). Technology friendly science teachers' views of educational information network (EBA). *Necatibey Faculty of Education Journal of Electronic Science and Mathematics Education, 12(1)*, 493-526.

Sarı, U., & Güven, G. (2013). The Effect of interactive whiteboard supported inquiry based learning on achievement and motivation in. *Necatibey Faculty of Education, Electronic Journal of Science and Mathematics Education, 7(2)*, 110-143.

Schermelleh, E., & Moosbrugger, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research Online, 8*.

Sharma, B. (2016). A focus on reliability in developmental research through cronbach's alpha among medical, dental and paramedical professionals. *Asian Pacific Journal of Health Sciences, 3*, 271-278. Doi: 10.21276/apjhs.2016.3.4.43.

Shi, J., Mo, X., & Sun, Z. (2012). Content validity index in scale development. Zhong nan da xue xue bao. *Journal of Central South University. Medical Sciences*, 152-155.

Shih, B., Chen, T., Cheng, M., Chen, C., & Chen, B. (2013). How to manipulate interactive e-book on learning natural catastrophe—an example of structural mechanics using power machine. *Natural Hazards, 65(3)*, 1637-1652.

Sinclair, P., Kable, A., & Levett-Jones, T. (2015). The efectiveness of internet-based e-learning on clinician behavior and patient outcomes: a systematic review protocol. *JBI Database Syst Reviews Implementation Reports, 13(1)*, 52-64.

Sing, K., & Chew, C. (2009). An inquiry approach in learning science with engaging web-based multimedia interactive resources. *International Science Education Conference.* Singapore.

Stirling, A., & Birt, J. (2014). An enriched multimedia e-book application to facilitate learning of anatomy. *Anatomical sciences education 2014, 7(1)*, 19-27.

Sun, H., & Zhang, P. (2006). Causal relationships between perceived enjoyment and perceived ease of use: An alternative approach. *Journal of the Association for Information Systems, 7(1)*, 24.

Sünkür, M., Arabacı, İ., & Şanlı, Ö. (2012). Secondary part of elementary schools students' views toward smart board pratices. *E-Journal of New World Sciences Academy, 7(1)*, 313-321.

Tabachnick, B., & Fidell, L. (2014). *Using multivariate statistics (New International Ed.).* Harlow: Pearson.

Tekin, H. (1977). *Quantitation and evaluation in education.* Ankara: Mars Publishing.

Tekışık, H. (1986). What is a textbook, how should it be selected. *Journal of Contemporary Education, 11(110)*, 1-3.

Thomas, J. (2007, July 20). *Project gutenberg digital library seeks to spur literacy*. (Bureau of International Information Programs) Retrieved September 24, 2022, from US Department of State: https://en.wikipedia.org/wiki/Project_Gutenberg

Thut, I., & Adams, D. (2005). *Pola-pola pendidikan dalam masyarakat kontemporer.* Yogyakarta: Pustaka Pelajar.

Turkmen, H. (2009). An effect of technology based inquiry approach on the learning of" Earth, Sun, & Moon" subject. *Asia-Pacific Forum on Science Learning & Teaching, 10(1)*, 1-20.

Ünveren Kapanadze, D. (2019). Evaluation of teaching turkish in the context of vygotsky's theory of sociocultural and cognitive development . *SDU Faculty of Arts and Sciences Journal of Social Sciences, 47*, 181-195. doi:10.35237/sufesosbil.565193

Wang, Q., & Woo, H. (2007). Systematic planning for ICT integration in topic learning. *Educational Technology and Society, 10(1)*, 148-156.

Wu, P., Kuo, C., Wu, H., Jen, T., & Hsu, Y. (2018). Learning benefts of secondary school students' inquiry-related curiosity: A cross-grade comparison of the relationships among learning experiences, curiosity, engagement, and inquiry abilities. *Science Education, 102(5)*, 917–950. doi:10.1002/sce.21456

Wynd, C. A., Schmidt, B., & Schaefer, M. A. (2003). Two quantitative approaches for estimating content validity. *Western journal of nursing research*, 508-518.

Yamane, T. (1967). *Statistics, An Introductory Analysis, 2nd Ed.* New York: Harper Row.

Yang, K., Wang, T., & Kao, Y. (2012). How an interactive whiteboard impacts a traditional classroom. *Education as Change, 16(2)*, 313-332.

Yusoff, M. S. B. (2019). ABC of content validation and content validity index calculation. *Education in Medicine Journal. 11(2)*, 49-54.

Zhang, D. (2005). Interactive multimedia-based e-learning: A study of effectiveness. *The American Journal of Distance Education, 19(3)*, 149-162.

Zhang-Kennedy, L., & Chiasson, S. (2016). Teaching with an interactive e-book to improve children's online privacy knowledge. *15th International Conference on Interaction Design and Children.* Manchester, United Kingdom.

Appendix A. Acceptance Scale towards interactive e-book of the secondary school students

Dimensions	Code	Items	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
	PEU1	Item22:Interactive e-books can be useful for students.					
	PEU2	Item17: I think it is necessary to use interactive e-books in lessons.					
PEU	PEU3	Item9: We can be more creative with the interactive e-book.					
	PEU4	Item12: Activities can be carried out more easily with interactive e-books.					
	PEU5	Item11: Using interactive e-books is easy.					

	PEU6	Item10: I think interactive e-books are necessary for lessons.
	PEU7	Item1: It is useful to use interactive e-books in lessons.
PU	PU1	Item29:Lessons using interactive e-books are more fun.
	PU2	Item31:Interactive e-books help me to be more successful in my lessons.
	PU3	Item30:I like to study interactive e-books.
	PU4	Item25:I can study with interactive e-books.
	PU5	Item26:I can enjoy classes using interactive e-books.
	PU6	Item21:Education can be fun with interactive e-books.
UA	UA1	Item8: We get lazy with the interactive e-book.
	UA2	Item7: Interactive ebook is a waste of time
	UA3	Item5: The interactive e-book prevents me from thinking creatively.
	UA4	Item4: I think interactive e-books are unnecessary.
BI	BI1	Item32:I know interactive e-books.
	BI2	Item14: I am proficient in using interactive e-books.
	BI3	Item33:Technological devices such as computers, tablets, etc. are required for interactive e-books.