A MODEL FOR BELIEFS, TOOL ACCEPTANCE LEVELS AND WEB PEDAGOGICAL CONTENT KNOWLEDGE OF SCIENCE AND TECHNOLOGY PRESERVICE TEACHERS TOWARDS WEB BASED INSTRUCTION

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ABSTRACT

One of the applications applied most nowadays is web based instruction (WBI). Although there are many studies on WBI, no study which researched the relations between beliefs for WBI, WBI tools acceptance levels and web pedagogical content knowledge (WPCK) of science and technology pre-service teachers was found among these studies. The aim of this study is to examine this relation. In accordance with this aim, the study group of the study consisted of 363 pre-service teachers. The data collected from pre-service teachers under the research were collected with scales of belief, tools acceptance and WPCK towards WBI. 3 scales were used for the data collection in the research. The data were analyzed with structural equation modeling in the research. As a result of the research, behavioral and contextual beliefs in WBI beliefs were medium level. Perceived usefulness, ease of use, perceived attitude and intention positively affect WBI tools acceptance levels of pre-service teachers. When the relation between beliefs, tools acceptance levels and web pedagogical content knowledge of science and technology education pre-service teachers towards WBI is analyzed, it is seen that beliefs towards WBI affect acceptance levels of WBI tools and WBI tools acceptance levels affect web pedagogical content knowledge.

Keywords: **Science and technology preservice teacher, web based instruction belief, web based instruction tools acceptence, web pedagogical content knowledge.**

INTRODUCTION

Web Based Instruction (WBI) concept appeared with the very rapid development of internet which is one of the most important communication means of our day and its bringing into play in education-learning activities efficiently. There are many definitions of WBI. However, the basic point is that WBI is an innovative approach. Web Based Instruction (WBI) is defined by Khan (1997) as "a hypermedia-based instructional program which utilizes the attributes an resources of the World Wide Web to create a meaningful learning environment where learning is fostered and supported", by Hunt (1999) as "individualized instruction delivered over public or private computer networks and displayed by a web browser" and by Horton (2000) as "any purposeful application of web technologies to the task of educating a human being".

Changes were experienced in beliefs, attitudes and behaviors of students and teachers towards WBI with this type of instruction. These changes emerged with the requirement of having some qualifications of teachers regarding WBI. Teachers should have information literacy, research skills and technology skills and they should achieve a level of technological competence besides these skills while significantly integrating such activities into WBI (Lowther, Jones and Plants, 2000). For the teachers to be able to maintain WBI in an effective and efficient way, besides these skills and competences their beliefs and attitudes towards WBI should change positively, their WBI tools acceptance levels should be high and they should have web pedagogical content knowledge(WPCK), in other words self-sufficiency for internet. In this study, WBI beliefs, acceptance of WBI tools and WPCK of preservice teachers were researched.

WEB-BASED INSTRUCTION BELIEFS (WBIB)

The beliefs of learners play an important role in successfully achieving WBI besides their learning experiences (Kao & Tsai, 2009; Kao, Wu, & Tsai, 2009, Yang & Tsai, 2008). The structure of beliefs regarding WBI is based on the Theory of Planned Behavior (TPB). The Theory of Planned Behavior (TPB) was developed by Ajzen (1991) from Theory of Reasoned Action (Fishbein and Ajzen, 1975). In Theory of Reasoned Action, it was suggested that human behaviors are under the control of the individual (Fishbein and Ajzen, 2010). On the Theory of Planned Behavior, the missing point of Theory of Reasoned Action, in other words the lack of perceived behavior control emerging in situations depending of the formation conditions of behavior and on time was eliminated. According to The Theory of Planned Behavior, social behaviors of individuals are controlled by some factors which result from certain reasons and which are planned (Ajzen, 2011). These factors comprise of behavioral beliefs which are about the possible results or other attributes of a behavior, normative beliefs which are about the personal expectations of other people and control beliefs which are about the existence of factors which increase or prevent the performance of behavior.

It is possible to make the proposition that the intention for WBI is the most important determinant of carrying out WBI in performing the same successfully based on the theory of planned behavior and researches about beliefs and intention (Haney, Czerniak & Lumpe, 1998; Armitage & Conner, 2001; Norton, Richardson, Hartley, Newstead & Mayes, 2005; Artino, 2008). In researches based on this proposition (Kao & Tsai, 2009; Kao, Wu, & Tsai, 2009; Yang & Tsai, 2008), beliefs of WBI were analyzed in three subcomponents which are behavioral belief, contextual belief and perceived difficulty.

It was aimed to measure the expected positive behaviors and perceptions of teachers towards WBI with behavioral belief subcomponent, the perceptions of teachers with certain skills towards WBI under certain conditions with contextual belief subcomponent, the perceptions of teachers that WBI is difficult and complex with perceived difficulty (Kao, Wu, & Tsai, 2009).

These beliefs deal with how WBI is perceived by teachers and they affect the usage of WBI in an effective and efficient way and technology acceptance of teachers. Based on these, it is possible to say that the acceptance of WBI tools is affected by the beliefs towards WBI.

WEB-BASED INSTRUCTION TOOLS ACCEPTANCE MODEL (WBITAM)

The use and acceptance of technology gain importance with the rapid development and becoming widespread of technology. It was proved that technology usage was related with belief, attitude and intention of individuals who would use technology. With this approach, Technology Acceptance Model (TAM) was formed. Developed by Davis (1989), TAM is based of The Theory of Reasoned Action (TRA). TAM was formed in order to state how the behavioral components of attitude towards technology will be measured, to distinguish between beliefs and attitudes, and to state how external stimuli are associated with beliefs, attitudes and behavior (Davis, 1993).

According to TAM, technology acceptance is affected by the intention of use. Behavioral intention to use is under the influence of attitude towards using, perceived usefulness and perceived ease of use. Perceived usefulness and perceived ease of use are affected by external variables and they affect attitude towards using. Attitude affects intention and behavior.

The development of WBI tools and their efficiently usage in educational environments increased the importance of WBI tools. Based on the researches regarding the acceptance of WBI tools based on TAM (Davis, 1989; Davis, Bagozzi & Warshaw, 1989; Lederer, Maupin, Sena & Zhuang, 2000; Lu, Yu, Liu & Yao, 2003; Yi & Hwang, 2003; Ma & Liu, 2004; King & He, 2006; Masrom, 2007), it was studied in four subcomponents which are Perceived Ease of Use, Perceived Usefulness, Attitude Toward Using and Behavioral Intention to Use. When the acceptance of WBI tools by the teachers is combined with WPCK together with its subcomponents, it will ensure a more efficient WBI.

WEB PEDAGOGICAL CONTENT KNOWLEDGE (WPCK)

With the use of technology in education, the teachers should have Technological Pedagogical Content Knowledge. Technological Pedagogical Content Knowledge-TPCK model defines the relation between technological, pedagogical and content knowledge of teachers (Mishra & Koehler, 2006; Koehler & Mishra, 2009; Harris, Mishra & Koehler, 2009). With the becoming widespread of technology and internet and their efficient use in education-learning process, Lee, Tsai and Chang (2008; Lee & Tsai, 2010) developed Web Pedagogical Content Knowledge-WPCK model which puts forth the self sufficiency of teachers towards internet based on TPCK.

In WPCK Model, self-sufficiencies of teachers in WBI are defined. In this model, there are six basic factors of the structure whose components were defined by Lee, Tsai and Chang (2008):

- **Web-General: General self-sufficiencies of teachers towards web.**
- **Web-Communicative: Web communicative self-sufficiencies of teachers towards web based communication or web based interaction.**
- **Web-Pedagogical: Self-sufficiencies of teachers towards knowledge regarding existence, components and functions of teachers.**
- **Web-Content: Self-sufficiencies of teachers towards knowledge on attitudes and reinforcing content in web.**

- **Web-Pedagogical-Content: Self-sufficiencies of teachers towards knowledge on how to define proper online activities and proper pedagogy which supports online activities.**
- **Attitude towards Web Based Instruction: The accepted things by teachers regarding use of WBI.**

WPCK with its six basic factors is very important for an efficient WBI. Teachers with WPCK are individuals who are equipped with required teacher attributes for WBI, who believe WBI tools will provide an effective learning and who accept WBI and WBI tools. In brief, the innovation experienced with WBI also led the change of teachers. In this study, it is aimed to revealed the change experienced by teachers, by examining their beliefs towards WBI, their acceptance of WBI tools and WPCK.

RESEARCH MODEL AND HYPOTHESES

Although there are many studies on WBI, no study which researched the relations between beliefs for WBI, WBI tools acceptance levels and WPCK of science and technology preservice teachers was found among these studies. The aim of this study is to research the relation between WBI beliefs, acceptance levels of WBI tools and WPCK of science and technology preservice teachers. The following hypotheses form the framework of the study:

- **In beliefs of science and technology preservice teachers towards WBI;**
  - **Their perceived difficulty predicts their behavioral beliefs;**
  - **Their perceived difficulty and behavioral beliefs predict contextual beliefs.**
- **In acceptance levels of science and technology preservice teachers towards WBI tools;**
  - **Perceived ease of use and perceived usefulness towards WBI predict the attitude towards using these tools;**
  - **Perceived usefulness towards WBI and attitude towards using these tools predict behavioral intention to use.**
- **In web pedagogical content knowledge(WPCK) of science and technology preservice teachers;**
  - **Their general web knowledge predicts their web content knowledge;**
  - **Their communicative web knowledge and web content knowledge predict their WPCK.**
- **Science and technology preservice teachers;**
  - **Beliefs of science and technology preservice teachers towards WBI predict their WBI tools acceptance levels;**
  - **Their WBI tools acceptance levels predict their WPCK.**

METHOD

Participants

The participants of the research consist of 363 students studying in Sakarya University Education Faculty Department of Science and Technology Teaching. While there were 418 science and technology preservice teachers in the department from which participants group was selected, 371 preservice teachers who were accessed on the days when the scales were applied completed the scales.

8 of these scales were eliminated from the study since some of their information was missing.

Table: 1
General attributes of participants

Demographics	First Teaching Period		Second Teaching Period		Total
	Female	Male	Female	Male	
Freshman	36	12	35	10	93
Sophomore	37	13	37	15	102
Junior	24	14	26	11	75
Senior	28	18	31	16	93
Total	125	57	129	52	363

In the participants group, 254 (69.97%) of the preservice teachers are female and 109 (30.03%) are male. Preservice teachers are at the ages of 18 – 26 and their age average is (+SD) 20.84 ± 2.13. Preservice teachers have internet connection between half an hour and 6 hours. Daily internet use hour average of preservice teachers is (±SD) 2.03 ± 1.08. From these students, 134 (37%) stated that they had such an education and 229 (63%) stated that they did not have such an education. Besides this, 398 (%82) of the preservice teachers stated they could have WBI at any time thereafter and 65 (18%) stated that they did not want to have such an education.

Instruments

The data collected from preservice teachers under the research were collected with scales of belief, tools acceptance and WPCK towards WBI.

Web Based Instruction Beliefs Scale (WBIBS)

Web Based Instruction Beliefs Scale (WBIBS) was used to determine the beliefs of science and technology preservice teachers towards WBI. The scale comprises of 3 factors and 14 items in total and has the structure of 5-point Likert. The original of the scale was developed by Yang &Tsai (2008) for the university students. The scale was adapted to teachers by Kao &Tsai (2009). In this study, the scale which was reduced to 15 items by Kao &Tsai (2009) was translated into Turkish by the researchers and made appropriate for science and technology preservice teachers and 1 item was eliminated from the scale. 5 experts, 2 of who specializes in science and technology teaching and 3 of who specializes in distance education, were asked for their opinion. Confirmatory factor analysis was checked in validity studies and cronbach's alpha internal consistency coefficients were checked in reliability studies. As a result of second level confirmatory factor analysis, fit indexes of the scale were found as $\chi 2/df=2.57$, RMSEA=0.066, SRMR=0.028, CFI=0.99, NFI=0.98, NNFI=0.98, GFI=0.93 and AGFI=0.90. The internal consistency coefficient of Turkish scale was .87.

As a result of validity-reliability studies, the scale reached a 3-factor and 14-item structure. First factor of the scale is behavioral belief and it consists of 8 items. This factor measures anticipated behaviors and positive consequences of WBI. The sample item of the first factor is "Web -based learning can make concrete the abstract concepts in science courses with the help of the animations or simulations". Second factor is contextual belief and it includes 3 items.

This factor measures the belief that WBI will be more efficient in special cases. The sample item of the second factor is "Some contents in science courses are good for web-based learning while others might be suitable for the traditional form of teaching".

Third factor is perceived difficulty and consists of 3 items. This factor measures if WBI is perceived as difficult and complicated or not. The sample item of this factor is "To me, the online science courses would increase the teaching loads.". Cronbach's alpha value for first factor is 0.96, second factor is 0.95 and third factor is 0.71.

Web Based Instruction Tools Acceptance Model Scale (WBITAMS)

Web Based Instruction Tool Acceptance Model Scale (WBITAMS) was used in order to determine the acceptance levels of WBI tools by science and technology preservice teachers. The scale comprises of 4 factors and 15 items in total and has the structure of 5-point Likert. The scale was developed by researches based on the technology acceptance model developed by Davis (1989).

The scale was formed by Davis (1989) based on four factors in the theoretical substructure of technology acceptance model which are Perceived Ease of Use, Perceived Usefulness, Attitude Towards Using and Behavioral Intention to Use. Totally 15 items were written for this four factors by examining studies such as Davis (1989) and Masrom (2007) etc. 5 experts, 2 of whom specializes in science and technology teaching and 3 of whom specializes in distance education, were asked for their opinion.

Confirmatory factor analysis was checked in validity studies and cronbach's alpha internal consistency coefficients were checked in reliability studies. As a result of second level confirmatory factor analysis, fit indexes of the scale were found as $\chi 2/df=1.56$, RMSEA= 0.039, SRMR=0.037, CFI=0.99, NFI=0.98, NNFI=0.99, GFI=0.95 and AGFI=0.93. The internal consistency coefficient of Turkish scale was .92.As a result of validity - reliability studies, the scale reached a 4-factor and 15-item structure.

The first factor of the scale is perceived ease of use and it consists of 5 items. This factor measures the perception of learning how to use WBI tools easily without showing much effort. The sample item of first factor is "It is easy to learn how to use WBI tools". The second factor is perceived ease and consists of 4 items. This factor measures the positive tendencies and thoughts they have in relation with the increasing of performances in the work carried out using WBI tools. The sample item of the second factor is "WBI tools increases teaching performance".

The third factor is attitude towards using and consists of 3 items. This factor measures the tendency to give positive or negative reaction towards using WBI tools. The sample item of this factor is "Using WBI tools make the course funny". The fourth factor is behavioral intention to use and consists of 3 items.

This factor measures the behavioral intention to use WBI tools. The sample item of this factor is "I intend to use WBI tools in my teaching life". Cronbach's alpha value for first factor is 0.92, second factor is 0.91, third factor is 0.95 and fourth factor is 0.94.

Web Technological Pedagogical Content Knowledge Scale (WTPCKS)

The WTCPK scale contains 30 items on a 5-point Likert-type scale. It was developed by Lee &Tsai (2010) to assess WTCPK, and it has five sub-dimensions: Web-general, Web-communicative, Web-Pedagogical Knowledge, Web-Pedagogical-Content Knowledge and Web Based Instruction Attitude. Turkish adaptation of this scale had been done by Horzum (2011). Confirmatory factor analysis results are χ2/df=2.80 RMSEA=0.07, GFI=0.86, AGFI=0.80, IFI=0.91, CFI=0.91, NFI=0.89 and NNFI=0.91. The internal consistency coefficient of adapted scale was .94, and the test–retest reliability coefficient was .86. Cronbach's alpha value for scale is .95, first factor is 0.93, second factor is 0.91, third factor is 0.95, fourth factor is 0.91 and fifth factor is 0.94.

Data Collection

In order to carry out the necessary applications in the study, necessary permissions were received from Sakarya University Education Faculty, the scales were printed and they were applied based on voluntary participation. The students were not asked to give names or numbers in the application. Structural Equation Modeling was used in order to examine the factors of WBI belief, WBI tools acceptance and WTPCK scales and the relation between these factors. These analyses were carried out with LISREL 8.54 package program.

RESULTS

Firstly, each scale and descriptive statistics of their factors were examined in the study. Analysis results are given in Table 2.

Tablo: 2
Descriptive Statistic

Variable	Mean	Standard Dev.	Standard Error
WBI Belief	2.65	0.61	0.03
Behavioral Belief	3.60	1.01	0.05
Contextual Belief	2.96	1.28	0.07
Perceived Difficulty	1.40	0.61	0.03
WBI TAM	2.89	0.84	0.04
Perceived Ease of Use	3.00	1.03	0.05
Perceived Usefulness	2.79	1.09	0.06
Attitude Toward Use	3.47	1.25	0.07
Behavioral intention to use	2.28	1.16	0.06
WTPCK	2.90	0.78	0.04
Web General	3.07	1.03	0.06
Web Communicative	2.86	1.09	0.06
WCK	2.52	1.23	0.06
WPCK	2.43	0.94	0.05
WBIA	3.62	1.03	0.06

When Table: 1 is analyzed, it is seen that behavioral beliefs of preservice teachers in their beliefs towards WBI are above average; perceived difficulty is quite high and their contextual beliefs were close to average level. When the WBI tools acceptance levels of preservice teachers are analyzed, it is pointed out that perceived ease of use and perceived benefit are average, and although attitude towards use is above average, behavioral intention to use is low.

When WPCK of preservice teachers is analyzed, it is seen that their general web knowledge and their attitude towards WBI are above average and their web-communicative, web-content and WPCK were below average. It is understood that beliefs towards WBI; acceptance levels of tools and technological pedagogical content knowledge of preservice teachers are average.

A Model for Beliefs of Preservice Teachers Towards WBI

In structural equation modeling for web based instruction beliefs (WBIB) of science and technology preservice teachers, totally 14 observed items were included in 3 latent variables which are Perceived Difficulty (PD), Behavioral Belief (BB) and Contextual Belief (CB). The hypotheses that perceived difficulty predicts behavioral beliefs (h1a); perceived difficulty and behavioral beliefs predict contextual beliefs (h1b) were examined in the modeling. All coefficients between three latent variables comprising the model and observed 14 items are found to be significant ($p < .005$, $t > 1.96$). Indexes of the model were found as $\chi^2/df=2.45$, RMSEA= 0.063, SRMR=0.028, CFI=0.99, NFI=0.98, NNFI=0.98, GFI=0.95 and AGFI=0.90. All of them exceeded their commonly accepted levels, demonstrating that the measurement model exhibited a good fit. Standard path coefficients of the structural model are given in Figure:1.

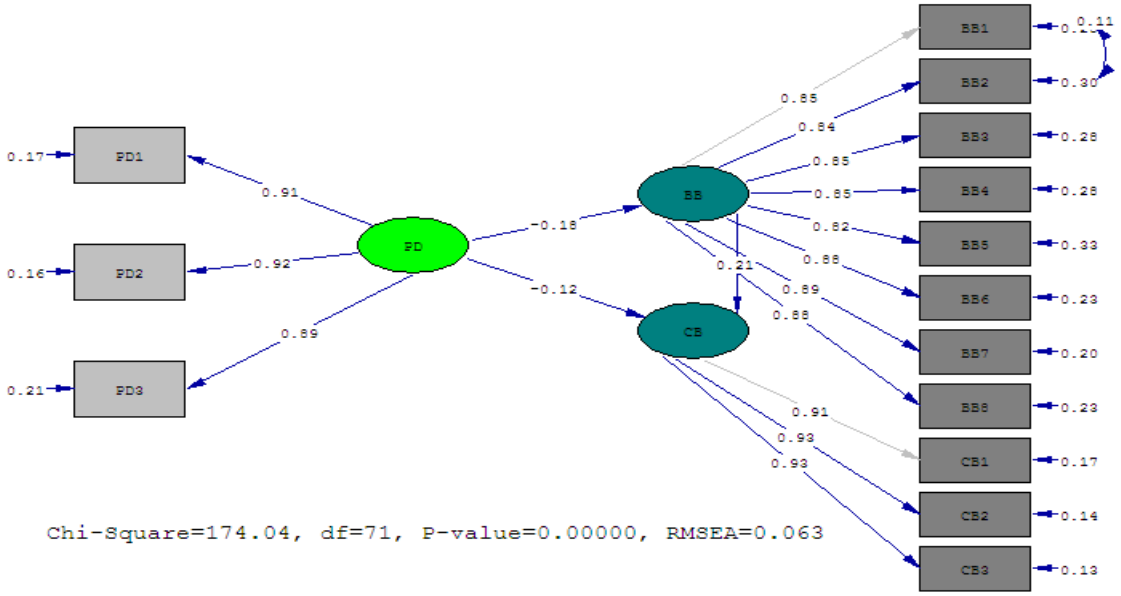

Figure: 1
The result of WBIB model (standardized coefficients)

When the model is analyzed, it is seen that decreasing perceived difficulty in WBI increases behavioral beliefs, and decreasing perceived difficulty and increasing behavioral beliefs increase contextual beliefs (h1a and h1b accepted). From this point of view, decreasing perceived difficulty and increasing positive result beliefs of science and technology preservice teachers towards WBI come into prominence for WBI to be used contextually in science and technology courses. When the effect of perceived difficulty on the behavioral belief is considered, it is found that perceived difficulty accounts for approximately 3.2% of variance of behavioral belief solely.

When the effect of perceived difficulty and behavioral belief on the contextual belief is considered, it accounts for approximately 6.6% of variance perceived difficulty and behavioral belief together.

Model for Acceptance of Preservice Teachers Towards WBI Tools

In the structural equation modeling for acceptance of web based instruction tools (WBITAM) by science and technology preservice teachers, 15 observed items were included in 4 latent variables which are Perceived Ease of Use (AKK), Perceived Usefulness (AF) Attitude Towards Using (KYT) and Behavioral Intention to Use (KYN). In the modeling, the hypotheses that perceived benefit and perceived usefulness predict attitude towards using these tools (h2a) and perceived benefit and perceived usefulness predict behavioral intention to use (h2b) were examined.

All coefficients between four latent variables comprising the model and observed 15 items are found to be significant ($p < .005$, $t > 1.96$). Indexes of the model were found as $\chi 2/df=1.44$, RMSEA= 0.035, SRMR=0.021, CFI=0.99, NFI=0.98, NNFI=0.99, GFI=0.96 and AGFI=0.94. All of them exceeded their commonly accepted levels, demonstrating that the measurement model exhibited a good fit. Standard path coefficients of the structural model are given in Figure: 2.

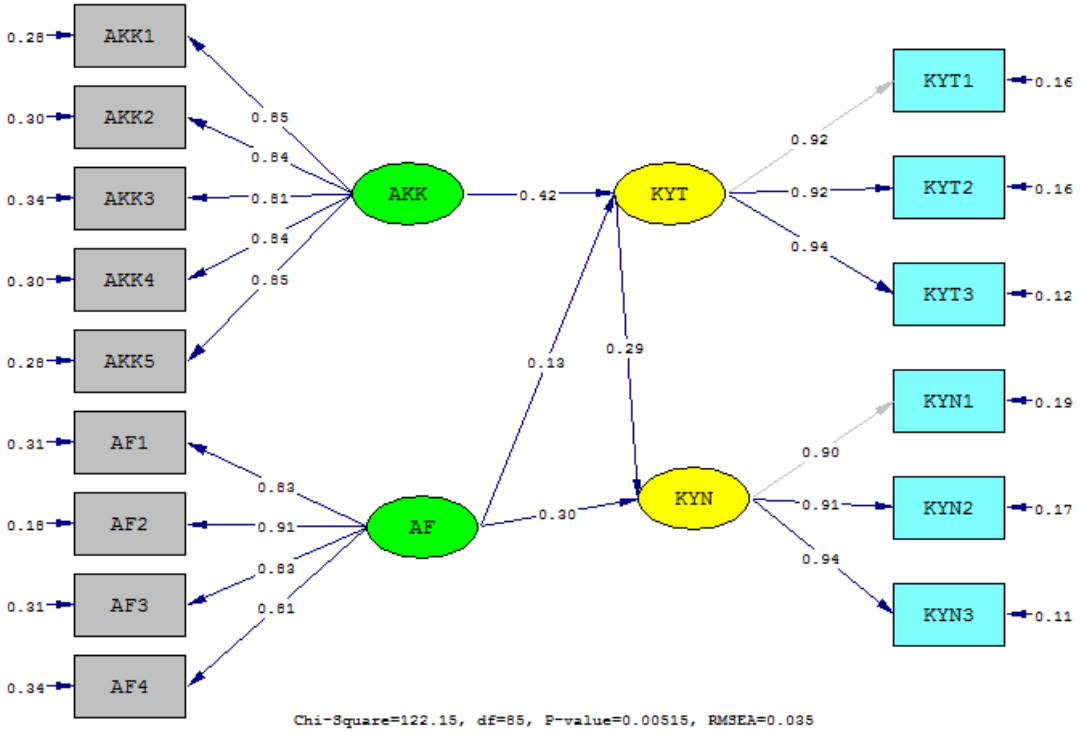

Figure: 2
The result of WBITAM (standardized coefficients)

When the model is analyzed, it is seen that perceived ease of use and perceived benefit regarding WBI tools has a positive effect on intention to use, and perceived benefit and attitude towards using has a positive effect on behavioral intention to use (h2a and h2b accepted).

In this aspect, the ease of use and beneficial perceptions of science and technology preservice teachers regarding WBI tools allows them to develop positive attitude towards using these tools.

In addition, perceiving WBI tools as beneficial and positive attitude towards using establish positive behavioral intention to use WBI tools in science and technology courses.It is found that perceived ease of use and perceived usefulness accounts for approximately 25% of variance of attitude toward using together. Beside it is found that perceived usefulness and attitude toward using accounts for approximately 23% of variance of behavioral intention to use.

A Model for Web Pedagogical Content Knowledge Of Science and Technology Preservice Teachers

In structural equation modeling of web pedagogical content knowledge (WPCK) of science and technology preservice teachers, 24 observed items were included in 4 latent variables which are Web General (WGE), Web Communicative (WCO), Web Content Knowledge (WCK) and Web Pedagogical Content Knowledge (WPCK). In the modeling, hypotheses that general web knowledge of preservice teachers predicts their web content knowledge (h3a) and their communicative web knowledge and web content knowledge predict their WPCK (h3b) were examined.All coefficients between four latent variables and observed 24 items are found to be significant ($p < .005$, $t > 1.96$). Indexes of the model were found as $\chi^2/df=2.42$, RMSEA= 0.063, SRMR=0.097, CFI=0.98, NFI=0.97, NNFI=0.98, GFI=0.85 and AGFI=0.88. Some of them exceeded their commonly accepted levels, demonstrating that the measurement model exhibited a good fit. Standard path coefficients of the structural model are given in Figure 3.

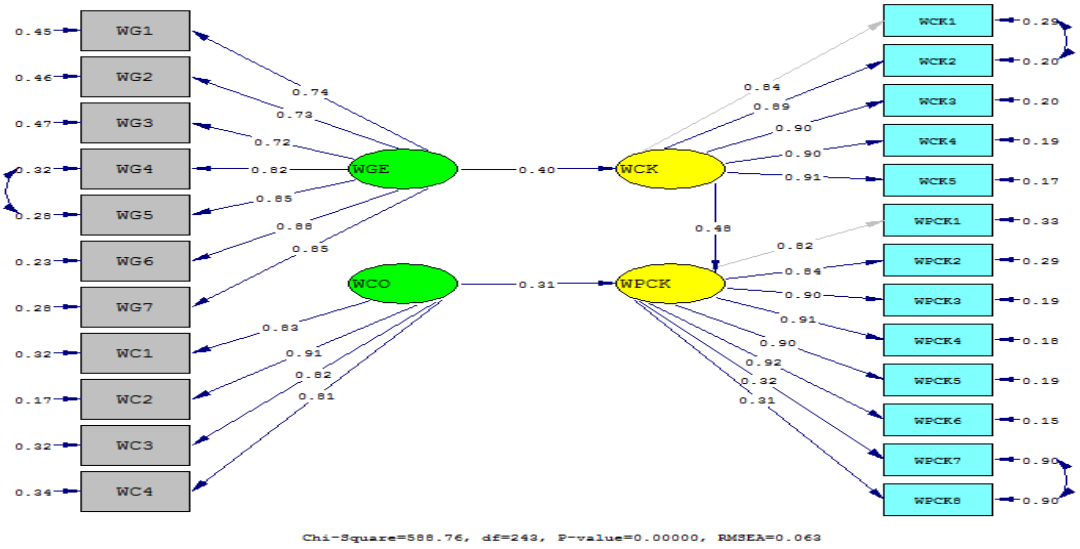

Figure: 3
The result of WPIB Model (standardized coefficients)

When the model is analyzed, it is seen that general web knowledge of science and technology preservice teachers has a positive effect on their content knowledge, and their communicative web knowledge and web content knowledge has a positive effect on WPCK (h3a and h3b accepted). In this aspect, general web knowledge of science and technology preservice teachers helps them to develop their web content knowledge positively. In addition, their communicative web knowledge and web content knowledge establish a positive effect on WPCK. It is found that web general accounts for approximately 16% of variance of web content knowledge solely. Beside it is found that web communicative and web content knowledge accounts for approximately 39% of variance of WPCK together.

A Model for Web Technological Pedagogical Content Knowledge of Science and Technology Preservice Teachers

While structuring the equation model to explain science and technology pre-service teacher's web technological pedagogical content knowledge, three latent variables, namely, WBI belief, WBI tools acceptance model and web technological pedagogical content knowledge were examined. The χ^2 (chi-square)/df (degree of freedom), Root Mean Square Error of Approximation (RMSEA), Root Mean Squared Residuals (RMR), Standardized Root Mean Squared Residuals (SRMR), Comparative Fit Index (CFI), Normed Fit Index (NFI), Non-Normed Fit Index (NNFI), Incremental Fit Index (IFI), Goodness of Fit Index (GFI) and Adjusted Goodness of Fit Index (AGFI) were used to see the appropriateness of the goodness-of-fit of the model. The model's goodness-of-fit values are indicated in Table: 3.

Table: 3

Fit indices for the model (Schermelleh-Engel, Moosbrugger, & Müller, 2003).

Fit indexes	Perfect fit	Model results
χ^2/df	χ^2/df<3	1.89
RMSEA	0 < RMSEA < 0.05	0.05
SRMR	*SRMR* <0.05	0.05
CFI	0.97 < CFI < 1	0.97
NFI	0.95 < NFI < 1	0.95
NNFI	0.97 < NNFI < 1	0.97
GFI	0.95 < GFI < 1	0.96
AGFI	0.90 < AGFI < 1	0.93

In Table 3, all of the indexes are perfect fit, demonstrating that the measurement model exhibited a good fit. Standard path coefficients of the structural model are given in Figure 4.

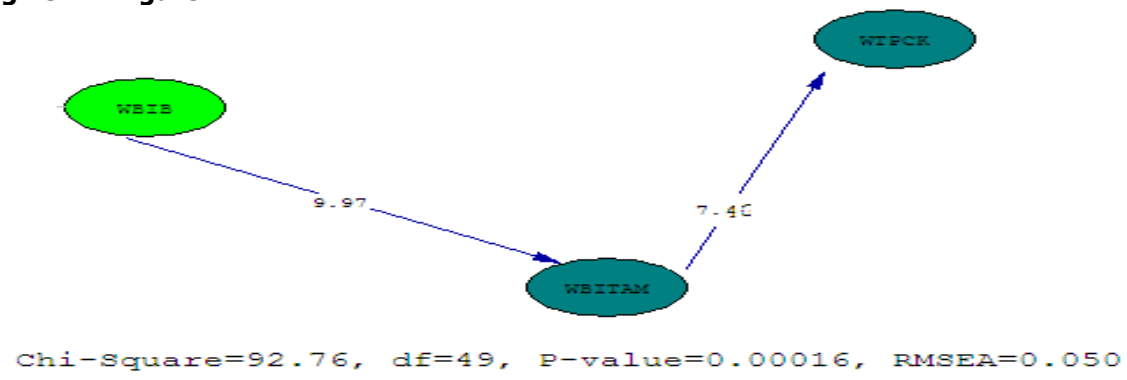

Figure: 4

The result of WTPIB Model (standardized coefficients)

T-values between observed and latent variables and path coefficients are listed in Figure 4. Path coefficients, T-values and covariance matrix of latent variables are presented below Table: 4 and 5.

Table: 4 Path coefficients and T-values

Latent variables	Observed variables	Path coefficients	T-value
Web Based Instruction Beliefs (WBIB)	Perceived Difficulty (PD)	-0.40	-6.60
	Behavioral Belief (BB)	0.72	10.88
	Contextual Belief (CB)	0.34	5.67
Web Based Instruction Tools Acceptance Model (WBITAM)	Perceived Ease of Use (PEU)	0.78	12.13
	Perceived Usefulness (PU)	0.70	11.49
	Attitude Toward Using (ATU)	0.67	11.26
	Behavioral Intention to Use (BIU)	0.57	9.36
Web Technological Pedagogical Content Knowledge (WTPCK)	Web General (WGE)	0.45	6.81
	Web Communicative (WCO)	0.67	8.59
	Web Content Knowledge (WCK)	0.76	7.42
	Web Pedagogical Content Knowledge (WPCK)	0.79	7.45
	Web Based Instruction Attitude (WBIA)	0.41	6.77

All the coefficients between WBIB and its observed variables, WBITAM and its observed variables, WTPCK and its observed variables are found to be significant (p <.005, t> 1.96). This result showed that BB and CB observed variables have significant positive influence but PD observed variable has significant negative influence on WBIB. Furthermore PEU, PU, ATU and BIU observed variables have significant positive influence on WBITAM. Then WGE, WCO, WCK, WPCK and WBIA observed variables have significant positive influence on WTPCK.

Table: 5 Covariance Matrix of Latent Variables

	WBIB	WBITAM	WTPCK
WBIB	1.00		
WBITAM	0.84	1.00	
WTPCK	0.59	0.63	1.00

When the effect of WBIB on the WBITAM is examined, standardized path coefficient is found to be 0.84, and the t-value is found to be 9.97. Hence, this result supports the view that WBIB has a significant positive effect on WBITAM (p<.005). In addition, it is found that WBIB with its determinants accounted for approximately 66% (R^2) of the variance of WBITAM.

Table: 6
Estimated structural equation between latent variables

Relation between latent variables	Estimated structural equation
WBITAM-WBIB	WBITAM=0.84*WBIB, Errorvar.= 0.35, R^2=0.66 (0.084) (0.11) 9.973.16
WTPCK-WBITAM	WTPCK=0.63*WBITAM, Errorvar.= 0.21, R^2=0.40 (0.051) (0.15) 7.483.94
WTPCK-WBIB	WTPCK=0.59* WBIB, Errorvar.= 0.58, R^2=0.35 (0.043) (7.01)

When the effect of WBITAM on the WTPCK is examined, the standardized path coefficient is found to be 0.63, and the t-value is found to be 7.48.Hence, this result supports the view that WBITAM has a significant positive effect on the WTPCK ($p < .005$). Similarly, it is found that WBITAM with their determinants by WBIB account for approximately 40% (R^2) of the variance of WTPCK. When the direct effect of WBIB on the WTPCK is considered, it is found that WBIB accounts for approximately 35% of variance of WTPCK solely.

DISCUSSION

Internet has become one of the tools that are benefited the most. It is so that people benefit from internet in every area of their lives. One of these main areas is education. Web Based Instruction (WBI) which is one of education applications via internet is stated one of the widely used applications. First WBI applications were started by colleges, universities and companies in USA in 1997 and 10% of colleges and universities and 25% of big companies published courses over web in two years. In 2001, these numbers became about 80% for universities and colleges and about 60% for companies (Lynch, 2002). In 2005 the number of students following courses on WBI reached to 3.6 million which marked an increase of 360,000 people compared to the previous year. 2.6 million of these come from non graduate universities (Allen & Seaman, 2006).

This number reached to 4.6 million in 2008 (Allen & Seaman, 2010). These developments show that WBI is a effective application for teaching and learning and it is more likely to be used in much wider fashion in future.

Technology based applications such as WBI are used often in science and technology education (Chang, Chang & Tseng, 2010). There are many researched on this (Adams, Alhadlaq, Malley, Perkins, Olson, Alshaya, Alabdulkareem & Wieman, 2012; Annetta & Minogue, 2004; Boone, 1996; Campbell & Storo, 1996; Crippen, 2003; Jackson, 1998; Kumar & Altschuld, 2002; Sun & Looi, 2012). In this respect, using WBI in science and technology education can be dealt with a process which develops depending on teachers and preservice teachers.

As a result of this study carried out to examine the relation between WBI beliefs, WBI tools acceptance levels and WPCK of science and technology preservice teachers, the hypotheses which form the framework of this study were tested.

According to findings, a model which includes the relation between WBI beliefs, WBI tools acceptance levels and WPCK of preservice teachers was formed.

In findings regarding WBI beliefs of science and technology preservice teachers, it was observed that decreasing perceived difficulty in WBI increases behavioral beliefs and decreasing perceived difficulty and increasing behavioral beliefs increase contextual beliefs.

Based on these findings, it is possible to say that the first hypothesis is confirmed. The results of this research are consistent with the findings of Ajzen (2002) and study findings of Yang & Tsai (2008) and Yang & Chang regarding beliefs of students.

It is consistent with the finding of Kao & Tsai (2009) that behavioral, contextual and perceived difficulty are three basic variables in beliefs of teachers towards WBI and they are related with each other. Science and technology preservice teachers can use WBI contextually in science and technology teachers by decreasing perceived difficulty towards WBI and increasing positive result beliefs. Hermans, Haytko and Mott-Stenerson (2009) found in their study that students encounter many difficulties in WBI environments and these difficulties affect the acceptance and satisfaction of this instruction by the students negatively.

In findings regarding WBI tools acceptance levels of science and technology preservice teachers, perceived ease of use and perceived benefit regarding WBI tools have a positive effect on intention to use, and perceived benefit and attitude towards using have a positive effect on intention to use.

These findings confirm the second hypothesis of the research. At the same time, sub-factors of technology acceptance model are similar in terms of WBI tools acceptance and are consistent with literature (Arbaugh, 2005; Davis, Bagozzi and Warshaw, 1989; Jong & Wang, 2009; Gong, Xu & Yu, 2004; Lertlum & Papasratorn, 2006; Liu, Liao & Pratt, 2009; Martins and Kellermanns, 2004; Masrom, 2007; Park, 2009; Smarkola, 2011; Venkatesh and Davis, 2000; Waheed, 2009; Yi & Hwang, 2003). Ease of use and usefulness of science and technology preservice teachers regarding WBI tools allow them for developing positive attitude towards using these tools, and perceiving WBI tools usefulness and positive attitude towards using allows for developing positive intention to use WBI tools in science and technology courses. Jong & Wang (2009) proved that performance expectation of system use, attitude towards using internet or LMS, self-sufficiency and social influence are important factors in acceptance of WBI tools.

It was also emphasized that social influence is an important factor in intention. In this aspect, it is considered important to try to establish a social influence to increase the acceptance of WBI tools in science and technology teachers. For this purpose, it is important to give prominence to the teachers using this instruction method or to provide support to use it.

In findings regarding WPCK of science and technology preservice teachers, it is seen that general web knowledge of science and technology preservice teachers has a positive effect on their web content knowledge; their communicative web knowledge and web content knowledge have a positive effect on WPCK. These findings prove that third hypothesis is confirmed. This finding is consistent with the findings of Lee & Tsai (2008, 2010) and Horzum (2011).

In this aspect, it is important for preservice teachers to improve their general and communicative web knowledge in order to found the base of WBI. It is stated that participating in WBI applications of teachers and preservice teachers makes a positive contributing to increasing their web pedagogical knowledge and it is also effective in gaining experience (Horzum, 2012).

When the relation between beliefs, tools acceptance levels and WPCK of science and technology preservice teachers towards WBI is analyzed, it is seen that beliefs towards WBI affect acceptance levels of WBI tools and WBI tools acceptance levels affect WPCK.

Fourth hypothesis is confirmed with these findings, and a model which suggests that belief towards WBI and tools acceptance levels affect WPCK appeared. In the model, it was found that WBI beliefs reinforce acceptance of WBI tools and acceptance of WBI tools reinforces WPCK.

All these findings can be explained with the statements that belief and attitudes are influential on acceptance of technology by Davis, Bagozzi and Warshaw (1989), behavioral and contextual beliefs are related with perceived usefulness, ease of use and intention to use which are the components of technology acceptance by Kao & Tsai (2009), and perceptions and experiences towards WBI increase WPCK by Horzum (2012).

The results of the research are consistent with the researches of Bhattacherjee & Premkumar, (2004), Fives & Buehl (2008) and Russell, Bebell, O'Dwyer, & O'Connor who emphasized that beliefs of teachers affect intention to use technology.

In the light of these findings, it was determined that beliefs towards WBI and WBI tools acceptance levels and WPCK have an effect on WBI uses of teachers. Teachers with positive beliefs towards WBI accept WBI tools more. Teachers with high acceptance levels of WBI tools have more WPCK. Kao, Wu & Tsai (2011) suggest that some example online courses or programs should be used in the education of teachers for them to use WBI efficiently in a country whose technology infrastructure is strong and whose internet use is high.

The courses or trainings in which preservice teachers or teachers participate are considered important for recognizing such applications and gaining experience. Such gained experience is considered to found a base for benefiting from such applications in their future professional lives of teachers.

Different applications are suggested for countries with a weak internet and technology infrastructure. Boitshwarelo (2009) emphasizes in a case study that co-education applications come into prominence in university educations and educations of science and technology teachers in places where technology infrastructure are not sufficient.

Based on the findings obtained as a result of research, some recommendations can be established for further researches. In this research, science and technology preservice teachers were selected as sample.

In further studies, studies can be made with science and technology teachers and teachers and preservice teachers in other areas. For understanding better the belief, tools acceptance levels and WPCK which are basic variables of this study towards WBI, deeper studies can be carried out with teachers, students and academic staff in elementary, secondary and higher education.

This study was planned in accordance with quantitative research methods and data were collected accordingly.

In further studies, deeper information can be obtained regarding variables by determining qualitative or mixed research approaches in order to gain deeper details.

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