Exploring the Effect of Collaborative Learning on Teacher Candidates' Intentions to Use Web 2.0 Technologies

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Abstract

The purpose of this study was to examine teacher candidates" pre and post intentions to use web 2.0 technologies for teaching before and after a collaborative learning process. An extended TAM was used in the current study. This study was designed as a one-group pretest-posttest design with 56 teacher candidates. In the experiment process, the instructor taught the design principles and how to use and design instructional materials with selected web 2.0 technologies. Then the teacher candidates worked in small groups to design the instructional materials with web 2.0 technologies. The data collection tool was administered before and after the experiment. Data were analyzed through partial least squares structural equation modeling. The results indicated that 4 of the 7 hypotheses were supported in the pre-acceptance model while all hypotheses were accepted in the post-acceptance model. The proposed model can be used as an appropriate framework for examining factors influencing teacher candidates" intentions to use web 2.0 technologies for teaching.

Keywords: Web 2.0 technology, structural equation modeling, teacher candidate, acceptance.

Introduction

New technologies can both provide numerous opportunities for learning environments and improve the 21st skills of learners in the digital age (OECD, 2019). One of these technologies is web 2.0 technologies. They are a kind of internet technology and can be used for enhancing learning and teaching environments. Web 2.0 technologies are web applications that allow collaboration, communication, and content share among users (Butler, 2012). There are many web 2.0 tools developed for different purposes in education one of which can be used to create different instructional materials such as textbooks, infographics, posters, quizzes, and mind maps.

Today, students can be described as digital natives being experts in using a different technology (Prensky, 2001). For example, they use several web 2.0 technologies such as social networks, blogs, social bookmarking (Pence, 2007). Furthermore, these technologies provide many opportunities during the learning process such as sharing information and collaboration among students (Ajjan & Hartshorne, 2008) In this regard integrating web 2.0 technologies into the learning environments of the digital age is important. Thus, teachers should not only use the web 2.0 technologies for personal aims but also use them to create learning activities to support students" learning (Jimoyiannis, Tsiotakis, Roussinos, & Siorenta, 2013). Moreover, it is emphasized in many reports such as the International Society for Technology in Education (ISTE, 2017) and UNESCO (2008) that teachers have to be equipped with some technological skills. In this regard, instructors should teach the opportunities that web 2.0 technologies provide and how to overcome problems when using them to the teacher candidates in the courses. However, training or courses may not ensure that teacher candidates will use web 2.0 technologies in the future. Therefore, as teachers of the future, teacher candidates" intentions to use web 2.0 technologies for teaching can be investigated with the help of the technology acceptance model (TAM) (Davis, 1989). Some studies investigated teacher candidates" intentions to use several technologies in the future teaching such as computers (Teo, 2009; Teo, Ursavaş, & Bahçekapili, 2012), interactive whiteboard (Baydaş & Yilmaz, 2017; Wong, Russo, & McDowall, 2013), and web 2.0 technologies (Cheon, Song, Jones, & Nam, 2010; Sadaf, Newby, & Ertmer, 2012). Accordingly, there are limited examining factors that influence teacher candidates" pre and post intentions to use web 2.0 technologies for teaching. However, it should be noted that instructors can design courses to teach these tools in a meaningful way to enhance their intentions to use them in

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their future teaching (Valtonen et al., 2015). One of the innovative ways is the collaborative learning approach where learners can work in a group and learn the content together (Dillenbourg, 1999). This approach was used for designing instructional materials with web 2.0 technologies in the current study. Therefore, the collaborative activities that teacher candidates do can be taken into consideration and added to the TAM to explain their acceptance behaviors. In this context, teacher candidates" intentions to use web 2.0 tools for teaching can be investigated before and after the collaborative learning process. As a consequence, the current study aimed to examine teacher candidates" pre and post intentions to use web 2.0 technologies for their future teaching before and after the collaborative learning process.

Theoretical Framework

Web 2.0 Technologies

Almost all students can be seen as an expert in using different information and communication technologies (ICT) for learning as they live and grow up with digital technologies doing different activities such as blogging, playing online games, and sharing interests (Redecker, 2009). Furthermore, students as digital natives prefer graphics when studying something (Prensky, 2001). Therefore, teachers that educate the new generation should have technological skills.

Web 2.0 technologies are services and tools that users can access any content, create knowledge, and share new knowledge with other users. Web 2.0 technologies have some benefits such as facilitating content creation and sharing it easily, accessing information easily, and collaborating with users (Mcloughlin & Lee, 2007). Due to the characteristics of web 2.0 tools, interactive learning environments can be designed where users can participate in the knowledge construction actively (Cakir, Yukselturk, & Top, 2015; Conole, 2010). There have been many attempts to integrate web 2.0 technologies in education. Hew and Cheung (2013) reviewed some of these studies. They expressed that there was a positive relationship between learning achievement and web 2.0 tools usage. In another review, Redecker (2009) reported the potential benefits of web 2.0 technologies as increasing accessibility of instructional materials, improving achievement, developing learning and higher-order skills, easing knowledge management, and providing advanced tools for a certain subject. Through these potentials of web 2.0 technologies, teacher candidates should be trained about how to use these technologies for teaching.

Collaborative Learning

To form teacher candidates" beliefs, a collaborative learning approach can be useful. The underlying premise of the collaborative learning approach is that students work in small groups for maximizing their learning together (Johnson &Johnson, 1996). Collaborative learning is grounded on social constructivism which is based on the studies of Vygotsky (Duffy & Cunningham, 1996). Collaborative learning assumes that teachers are seen as facilitators and two or more students form a group and engage in learning to solve a problem or achieve a goal doing activities such as participating in the process actively, taking responsibilities, discussing groupmates" findings or ideas, sharing experiences (Matthews, Cooper, Davidson, & Hawkes, 1995). On the other hand, Vygotsky stated the importance of social interaction when constructing knowledge (Duffy & Cunningham, 1996). Therefore, using ICT can be beneficial for the learning process.

Integration of ICT in the collaborative learning environment makes critical contributions to students through providing opportunities for social interaction (Kreijns, Kirschner, & Jochems, 2003). Use of ICT with collaborative learning approach has several benefits such as improvement of higher-order thinking skills, satisfaction with the learning experience, development of productivity (Resta & Laferrière, 2007), knowledge gain, skill acquisition, and positive perception development (Chen, Wang, Kirschner, & Tsai, 2018). Additionally, the use of ICT in the collaborative learning environment enhances group task performance and social interaction (Chen et al., 2018). In this regard, using ICT with the collaborative learning approach can be a better way for equipping teacher candidates with skills about web 2.0 technologies and forming their intentions because users" intentions to use any information system can change with experiences (Venkatesh & Davis, 2000).

Technology Acceptance Model

Some intention-based theories and models have been developed to investigate users" acceptance and adoption of technologies. For example, Davis (1986) introduced TAM for the explanation of computer usage behavior. Thus, the literature counts various applications of not only TAM but also other intention-based theories and models in the research.

There are several studies about teacher candidates", or university students" intentions to use web 2.0 technologies with the help of different intention-based models. For example, Cheon et al. (2010) explored teacher candidates" intentions to adopt web 2.0 technologies with the help of expectancy-value theory after a training session. Yueh, Huang, and Chang (2015) explored university students" adoption of the Wiki system with the Unified Theory of Acceptance and Use of Technology (UTAUT) in the course. Sadaf, Newby, and Ertmer (2016) investigated teacher candidates" intentions and actual uses of web 2.0 technologies in classrooms with the decomposed theory of planned behavior. In a similar study, Huang, Hood, and Yoo (2013) examined teacher candidates" acceptance of web 2.0 tools with the UTAUT model after they enrolled in an educational technology course. Yilmaz and Baydas (2016) examined the factors influencing teacher candidates" behavioral intention to make educational animated movies with a web 2.0 tool at the end of the course. Altanopoulou and Tselios (2017) explored university students" intentions to use wiki before and after the actual use of the wiki system with the help of TAM and added constructs as Big Five personality characteristics. Kul and Çelik (2018) designed a multiple case study and explored teacher candidates" intentions to use web 2.0 technologies for teaching mathematics by using the decomposed theory of planned behavior at the beginning, middle, and end of the course. Arslan (2019) aimed to determine teacher candidates" perceptions towards Web 2.0 tools and intentions at the end of the instructional technology and material development course using TAM. Teo, Sang, Mei, and Hoi (2019) designed a cross-sectional study aiming to explore teacher candidates" acceptance of web 2.0 technologies using extended TAM. Alkhayat, Ernest, and La Chenaye (2020) used the decomposed theory of planned behavior and designed a qualitative study to examine early childhood teacher candidates" intentions to use Web 2.0 technologies in their future.

To summarize the related studies, some of them were based on participants" perceptions toward web 2.0 technologies without any experience process while others were conducted to explore participants" perceptions after the usage of web 2.0 technologies with different intention models. There have been limited studies that examine teacher candidates" intentions to use web 2.0 technologies before and after a training program or a course. In other words, the effect of meaningful and collaborative learning on teacher candidates" intention to use web 2.0 technologies can be tested. Therefore, the difference can be observed thanks to this study as it is emphasized that experience over time can affect intention (Davis, Bagozzi, & Warshaw, 1989). Moreover, policymakers, university administrators, and instructors can benefit from the result of the study about what may influence teacher candidates" intentions to use web 2.0 technologies. Thus, TAM was selected in this research as it is a valid and robust model confirmed by many studies (King & He, 2006). The strengths of TAM are being simple, and applicability to the different technology-related fields. However, researchers attempt to refine the model. In this regard, they extend the model by adding external variables that influence the core variables of the model (Granić & Marangunić, 2019). Thus, TAM can be extended within this research aim by adding the collaboration construct to increase prediction.

The intention to use (IU) is influenced by three main constructs in TAM. These are perceived usefulness (PU), perceived ease of use (PEU), and attitude (AT). Davis (1989, p. 320) defined PU as "the degree to which a person believes that using a particular system will enhance his or her job performance". He explained PEU as "the degree to which a person believes that using a particular system will be free of effort (Davis, 1989, p. 320). Another construct in the model is AT that is "a learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object" (Fishbein & Ajzen, 1975, p. 6). PU and AT have a direct effect on IU while PEU and PU are predictors of AT. Moreover, PEU has a direct effect on PU. Venkatesh and Davis (2000) reported that many studies using TAM explained 40% variance in behavioral intention. However, some of the researchers extended TAM by adding constructs to get a better explanatory power (Tarhini, Hone, Liu, & Tarhini, 2017; Yadegaridehkordi, Shuib, Nilashi, & Asadi, 2019). Therefore, the collaboration effort of teacher candidates was added to the model.

Research Model and Hypotheses

TAM was extended with a collaboration construct in the current study. Thus, the effect of the external variable on behavioral intention can be mediated by PU and PEU. The proposed model consists of the following variables: PU, PEU, AT, collaboration, and IU (see Fig. 1).
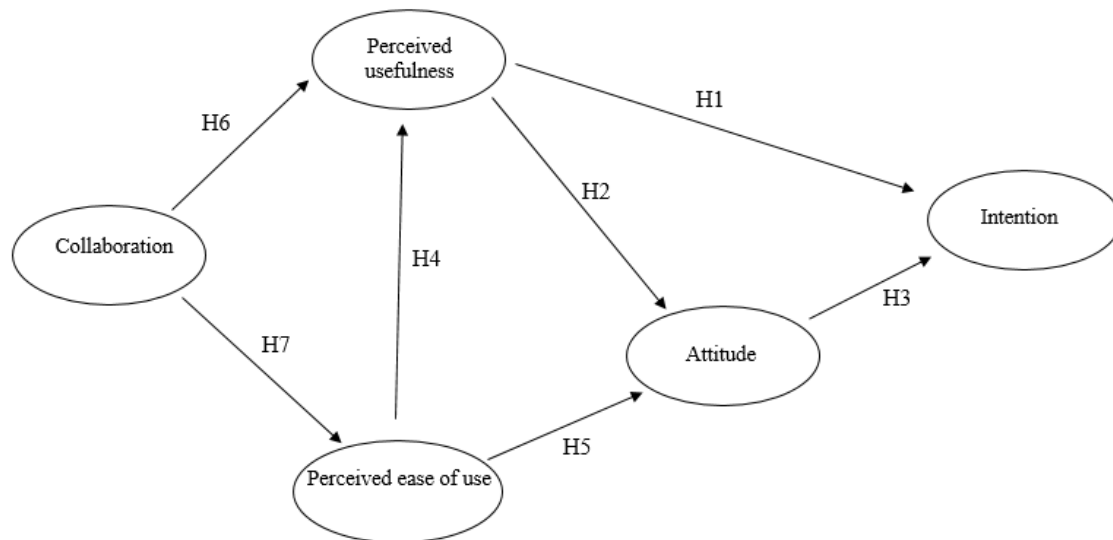

Figure 1. The research model

PU is described as using web 2.0 technologies will enhance teacher candidates" teaching performance. Therefore, if teacher candidates believe that incorporating web 2.0 technologies in the learning environments can be beneficial for their teaching performance, they will use these tools in future teaching. Moreover, this belief can influence their attitudes toward these tools. Many studies support the PU-BI (Esteban-Millat et al., 2018; Usoro, Echeng, & Majewski, 2014) and PU-AT (Ifinedo, 2017; Wang & Huang, 2016) relationships. Therefore, the following hypotheses are formulated:
H1: PU has a positive effect on IU.
H2: PU has a positive effect on AT toward web 2.0 tools.

AT can be explained as teacher candidates ‚positive or negative feelings toward using web 2.0 technologies for teaching activities. These feelings of teacher candidates can influence their future intentions. In the literature, this relationship is supported by previous studies (Sadaf et al., 2012; Ursavaş, Şahin, & Mcilroy, 2014). Therefore, it can be hypothesized that:
H3: AT toward web 2.0 tools has a positive effect on IU.

PEU is described as the degree to which teacher candidates believe that using web 2.0 technologies for teaching activities will be free of effort. This perception can affect their feelings toward web 2.0 technologies and their perceptions of usefulness about web 2.0 technologies. Previous studies support PEU-PU (Teo, Lee, & Chai, 2008; Venkatesh, 2000) and PEU-AT (Hsu & Lin, 2008; Park, 2009) relationships. Accordingly, the following hypotheses are proposed:
H4: PEU has a positive effect on PU.
H5: PEU has a positive effect on AT toward web 2.0 technologies.

Collaboration (C) can be explained as supporting learning in a group with the help of web 2.0 technologies that facilitate teacher candidates" collaborative efforts such as collaboration, communication, and interaction to accomplish the goal (Yadegaridehkordi et al., 2019). As a general statement, web 2.0 technologies support collaborative learning by facilitating activities such as accessing, sharing, and co-creating the content (Jimoyiannis, Tsiotakis, Roussinos, & Siorenta, 2013). In the current study, when teacher candidates used some of the web 2.0 technologies to collaborate, communicate and interact with groupmates, instructors, and other people around them, they might believe that these technologies helped them to complete their work easily and increase their performance. Moreover, this belief can affect their perceived ease of use of web 2.0 technologies. Previous studies stated the importance of the collaboration feature of web 2.0 tools for learning (Cheung & Vogel, 2013; Cilliers, 2017). Thus, the following hypotheses are presented:
H6: C has a positive effect on PU.

H7: C has a positive effect on PEU.

Method

Research Model

This study was designed as a one-group pretest-posttest design which was a type of quasi-experimental design (Fraenkel, Wallen, & Hyun, 2012). At the beginning of this study, teacher candidates responded to a survey about extended TAM elements and demographics. In the treatment session of the course, the instructor taught the design and development principles of instructional material and how to design digital materials with web 2.0 technologies. Teacher candidates created groups with 3-4 teacher candidates and worked in small groups to prepare four different instructional digital materials. After the session finished, they took the survey again as a posttest. To examine changes in factors that influenced teacher candidates'' intentions, the pretest and posttest data were used to establish structural models. Then pre-acceptance and post-acceptance models were compared according to the research hypotheses.

Participants

The participants of the study were 80 teacher candidates from the faculty of education at a public university in the Aegean Region of Turkey. All teacher candidates were in the second year at their departments. Although all participants participated in the study and fulfilled the survey, some participants did not complete the experiment. Therefore, the study was completed with 56 teacher candidates. Among them, 83.9% (n = 47) of the participants were female while 16.1% (n = 9) of them were male. The age of teacher candidates ranged from 19 to 28 and the average was 19.8. 42.9% (n = 24) of teacher candidates were from the department of primary school education, 37.5% (n = 21) of them were from the department of mathematics education, and 19.6% (n = 11) of them were from the department of Turkish Language Education. Additionally, 96.4% (n = 54) of the participants had no experience with web 2.0 usage in education while 3.6% (n = 2) of the participants had experiences with web 2.0 usage in education.

Experimental Procedure

This study was conducted in the Instructional Technology course. The course includes topics about basic concepts of instructional technology, instructional tools and materials, instructional material design and development, and evaluation of instructional materials. The experiment session of the study was started with the topic of instructional materials and material design and development. It continued for five weeks (see Fig. 2). Before the experiment was started, the survey was administered to teacher candidates and they created collaborative groups with 3-4 teacher candidates. The instructor gave lectures about the use of web 2.0 technologies in education, principles of designing visual materials, and which web 2.0 tool would be appropriate for designing each material weekly. Then the instructor introduced infographics, posters, mind maps, and quizzes as instructional materials. Therefore, Canva was selected for creating infographics and posters, Bubbl.us was preferred for designing mind maps, and Google Forms was selected for preparing online quizzes. For the collaborative design of instructional materials, each group created a group account in each web 2.0 tool. Therefore, each teacher candidate in groups made contributions to the digital material. Additionally, each group created a folder in Google Drive and shared it with groupmates and the instructor. Using Google Drive allows collaborative groups to work anywhere and anytime. These facilities enhanced interaction, collaboration, and communication among teacher candidates. As a consequence, each teacher candidate engaged in the learning process actively such as searching for design issues with web 2.0 tool and discussing and sharing the ideas. Finally, they developed the instructional digital materials collaboratively. At the end of this session, the survey was administered to teacher candidates as a posttest. According to the pretest data, the pre-acceptance model was established and analyzed while the post-acceptance model was established and analyzed based on the posttest data.
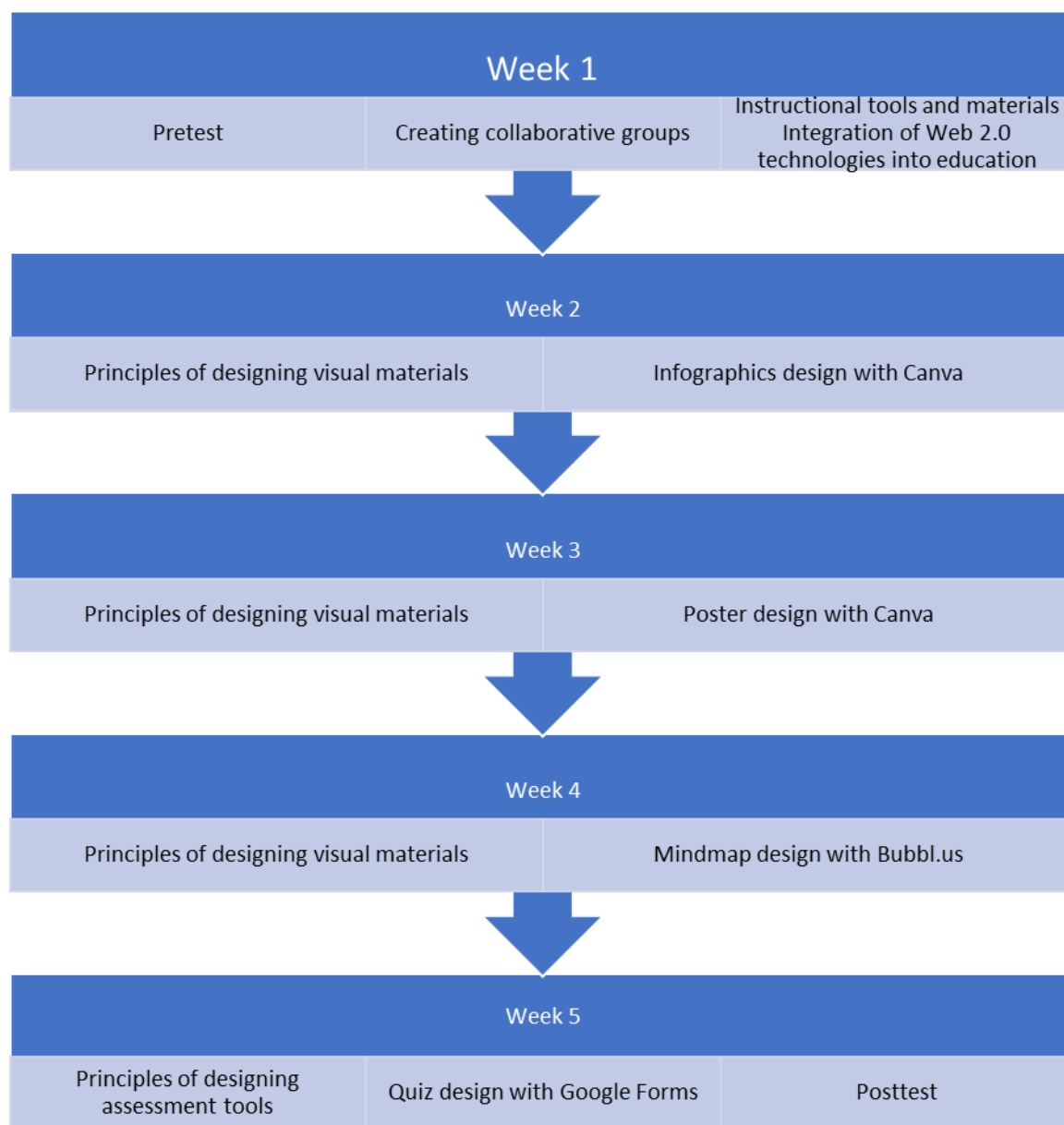
Figure 2. The implementation of the study

Data Collection Tools

The survey of this study consisted of two parts as demographics and scale items. Age, gender, department, experience with web 2.0 tools were used as demographic questions. The scale comprised of 19 items measured by 7 -point Likert scales ranging from "1=strongly disagree" to "7-strongly agree". The constructs of the scale were based on TAM. The items were in English. Therefore, the items were selected from previous studies to fit the purpose of this research. To do this, the selected items were translated into Turkish by two experts. Then two experts in both languages controlled the translated items. The final form of the scale was revised based on expert views (see Table 1).

Table 1. Items and constructs of the scale

Construct	Items	Reference
Perceived Usefulness	Pu1	Davis (1989)
	Pu2	
	Pu3	
	Pu4	
	Pu5	

Perceived Ease of Use	Peu1	Davis (1989)	
	Peu2		
	Peu3		
	Peu4		
Attitude	At1	Davis (1989)	
	At2		
	At3		
Intention to Use	Iu1	Bhattacherjee (2001a, 2001b)	
	Iu2		
	Iu3		
Collaboration	C1	(Baas, 2010)	
	C2		
	C3		
	C4		

Data Analysis

The Partial Least Square Structural Equation Modelling (PLS-SEM) was used to analyze the data. PLS-SEM is preferred than other SEM techniques because PLS-SEM is an appropriate technique where the sample size is small and the aim is to predict the key constructs on the dependent variable (Hair, Ringle, & Sarstedt, 2011). Therefore, the two-step analysis method was adopted with the SmartPLS 3.2.7 program. First, the measurement model was tested to find out the validity and reliability of measures for the pre-acceptance model and the post-acceptance model. Then the structural model was tested to reveal the relationship between constructs for both models.

Results

Results of the Measurement Models

Based on the data collected before the experiment, the pre-acceptance model was established while the post-acceptance model was established with the post-test data. First of all, the validity and reliability analysis was conducted to test the measurement models. Table 2 presents item loadings, internal consistency reliability values (Cronbach's Alpha and composite reliability (CR)), and convergent validity values. The item loadings in the pre and post-acceptance models were greater than 0.50 indicating that indicator reliability was ensured (Fornell & Larcker, 1981). Internal consistency was assessed with Cronbach's Alpha and CR values. The values of Cronbach's alpha and CR of all constructs in two models met the threshold of 0.7 (Hair et al., 2011). Convergent validity was assessed through the values of average variance extracted (AVE) which were exceeded 0.5 (Hair, Black, Babin, Anderson, & Tatham, 2006).

Table 2. Reliability and validity of measurement models

Construct	Item	Loading (Pre)	Loading (Post)	AVE (Pre)	AVE (Post)	CR (Pre)	CR (Post)	Cronbach's Alpha (Pre)	Cronbach's Alpha (Post)
Attitude				.838	.821	.939	.932	.903	.891
	AT1	0.914	0.869						
	AT2	0.913	0.919						
	AT3	0.919	0.929						
Intention to use				.860	.817	.949	.931	.919	.888
	IU1	0.921	0.905						
	IU2	0.940	0.870						
	IU3	0.921	0.935						
Perceived ease of use				.742	.706	.920	.905	.885	.860
	PEU1	0.784	0.816						
	PEU2	0.871	0.899						
	PEU3	0.870	0.801						

	PEU4	0.914	0.841					
Perceived usefulness				.802	.770	.953	.944	.938	.925
	PU1	0.891	0.882					
	PU2	0.858	0.913					
	PU3	0.925	0.922					
	PU4	0.929	0.844					
	PU5	0.872	0.825					
Collaboration				.802	.779	.953	.933	.927	.903
	C1	0.857	0.756					
	C2	0.955	0.917					
	C3	0.921	0.929					
	C4	0.890	0.917					

This study employed Fornell and Larcker"s (1981) criteria to assess discriminant validity. The square root of AVE values of each construct should exceed the correlation than its correlation with other constructs in the models. Table 3 exhibits the Fornell-Larcker criteria values for the pre-acceptance model while Table 4 presents the Fornell-Larcker criteria values for the post-acceptance model. The values were acceptable for both cases.

Table 3. Results of discriminant validity for pre-acceptance model

	AT	IU	C	PEU	PU
AT	**0.915**				
IU	0.825	**0.928**			
C	0.753	0.754	**0.907**		
PEU	0.464	0.522	0.522	**0.861**	
PU	0.579	0.586	0.488	0.541	**0.895**

Note. Bold diagonal: square root of AVE, below diagonal

Table 4. Results of discriminant validity for post-acceptance model

	AT	IU	C	PEU	PU
AT	**0.906**				
IU	0.781	**0.904**			
C	0.789	0.719	**0.883**		
PEU	0.682	0.560	0.625	**0.840**	
PU	0.637	0.665	0.684	0.723	**0.878**

Note. Bold diagonal: square root of AVE, below diagonal

Results of the Structural Models

To test the causal relationships of the structural models, the bootstrapping approach was handled with 5,000 subsamples. The predictive power of the model with R^2 values (see Table 6), beta coefficients (β), significance of the path coefficients (p), and t values are presented in Table 5 and Fig. 3 and 4.

Table 5. Summary of hypotheses testing

Hypothesis	Relationship	β		t		p		Supported	
		pre	post	pre	post	pre	post	pre	post
H1	PU→IU	0.163	0.281	1.554	3.039	0.120	0.002	No	Yes
H2	PU→AT	0.464	0.302	2.931	2.072	0.003	0.038	Yes	Yes
H3	AT→IU	0.730	0.602	8.314	5.622	0.000	0.000	Yes	Yes
H4	PEU→PU	0.393	0.484	2.266	4.306	0.023	0.000	Yes	Yes
H5	PEU→AT	0.213	0.464	1.173	3.178	0.241	0.001	No	Yes
H6	C→PU	0.283	0.381	1.777	3.680	0.076	0.000	No	Yes
H7	C→PEU	0.522	0.625	4.740	7.240	0.000	0.000	Yes	Yes

Table 6. Predictive relevance and explained variance

	R^2	
Endogenous Variables	Pre	Post

|		
AT	0.367	0.508
IU	0.698	0.657
PEU	0.273	0.391
PU	0.350	0.611

The analysis results of the pre-acceptance model showed that teacher candidates" intentions were predicted only by AT with a significant β value of 0.730 (p < 0.001). However, in the post-acceptance model, PU and AT were significant predictors of IU with significant β values of 0.281 ($p < 0.05$) and 0.602 ($p < 0.001$) respectively. Therefore, the H3 hypothesis was accepted for both models but the H1 hypothesis was supported for the post-acceptance model. The H2 hypothesis which stated the PU-AT relationship was confirmed with significant β values of 0.464 ($p < 0.01$) and 0.302 ($p < 0.05$) respectively for both models while the H5 hypothesis which stated the PEU-AT relationship was supported only for the post-acceptance model with significant β value of 0.464 ($p < 0.01$). The C and PEU had a significant effect on PU with significant β values of 0.381 ($p < 0.001$) and 0.484 ($p < 0.001$) respectively for the post-acceptance model whereas PEU had a significant effect on PU only in the pre-acceptance model with significant β values of 0.393 ($p < 0.05$). Therefore, the H4 hypothesis was accepted in both models while the H6 hypothesis was supported only for the post-acceptance model. H7 hypothesis which was about C-PEU relationship was supported for both models with significant β values of 0.522 ($p < 0.001$) and 0.625 ($p < 0.001$) respectively.

The predictive power of the models was assessed by R^2 values. The pre-acceptance model explained 69.8% variance on IU with AT construct while the post-acceptance model revealed 65.7% variance on IU with PU and AT constructs. According to Hair et al. (2011), the values of 0.75, 0.50, and 0.25 R^2 indicate a substantial, moderate, and weak model. Therefore, the pre and post-acceptance models can be seen as moderate models. Other R^2 values for AT, PU, and PEU were 0.367, 0.350, and 0.273 respectively for the pre-acceptance model while these values increased to 0.508, 0.611, and 0.391 for the post-acceptance model.
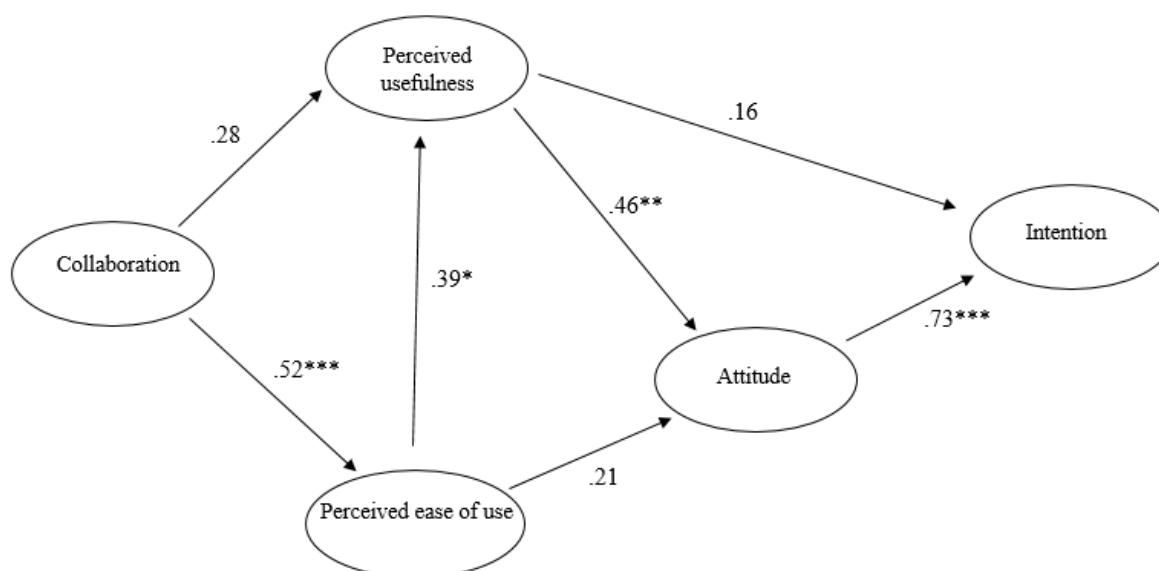
Note. *$p < .05$; **$p < .01$; ***$p < .001$
Figure 3. Results of structural model analysis for pre-acceptance
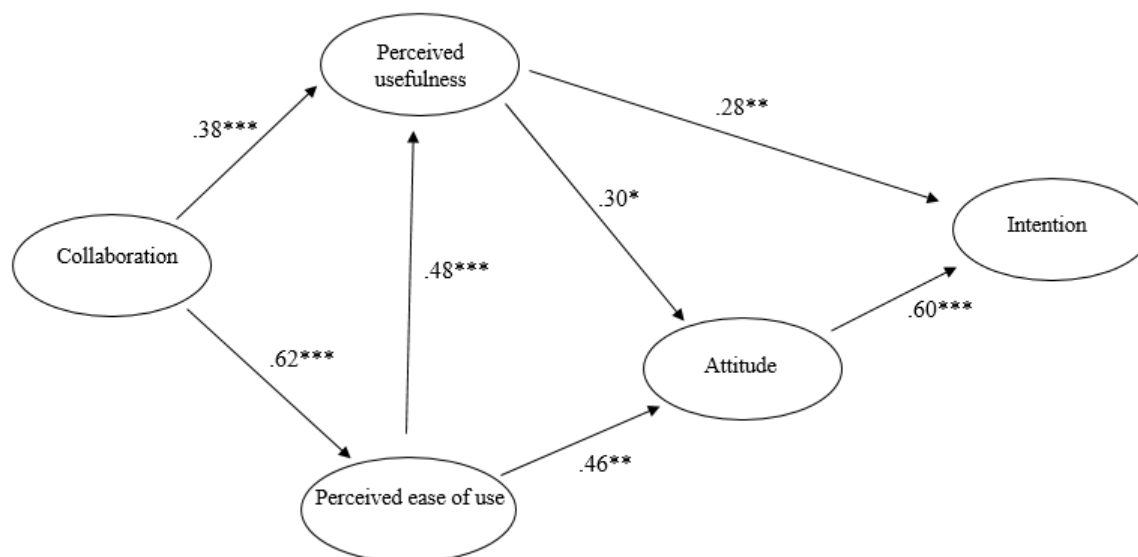
Note. *p* < .05; **p* < .01; ***p* < .001
Figure 4. Results of structural model analysis for post-acceptance

Discussion

This study was designed to examine possible changes in teacher candidates" intentions to use web 2.0 technologies for teaching in the future by incorporating collaboration construct into TAM. Therefore, a pretest-posttest design was used to monitor changes of intentions over a course session. The results indicated that four of seven hypotheses were supported in the pre-acceptance model while all hypotheses were accepted in the post-acceptance model. Although the pre-acceptance model explained a little higher variance in intention to use than the post-acceptance model, both models were moderate. Moreover, other R^2 values tended to increase from pre-acceptance to post-acceptance.

AT was the strongest and significant predictor of IU in both cases while PU was the significant predictor for the post-acceptance model. This finding is in line with previous research findings (Moreno, Cavazotte, & Alves, 2017; Wang & Huang, 2016). As an expected result, teacher candidates could have some positive feelings toward ICT before the course. After the collaborative learning activities, their feelings did not change so much. However, PU did not affect IU in the pre-acceptance model. As most of them were less experienced, they could evaluate the system as heuristically (Castañeda, Muñoz-Leiva, & Luque, 2007). Therefore, they did not have any perception about the effect of web 2.0 technology on their teaching in the future. As they used web 2.0 technologies in the collaborative groups, they realized the capabilities of web 2.0 technologies such as collaboration, interaction, and communication. Through collaborative activities for designing digital materials, they believed that these tools would help them to achieve their teaching goals in the future.

The other important result was that AT was predicted by PU in the pre-acceptance model whilst PEU and PU were the significant factors that influenced AT in the post-acceptance model. This finding is consistent with some previous research results (Altanopoulou & Tselios, 2017; Huang, 2017) In other words, teacher candidates" beliefs about tangible benefits of the web 2.0 technologies had an impact on their attitudes toward the use of web 2.0 tools before and after the experiment. Accordingly, PU had an indirect effect on IU in the pre-acceptance model. The positive change of effect of PEU on AT could be explained that teacher candidates worked in small groups and helped each other to design digital materials with these tools. As most of them utilized and operated these tools for the first time, they did not have any opinion about their use. As a result, teacher candidates who found web 2.0 technologies easy to use tended to have favorable positive attitudes toward the use of web 2.0 technologies for teaching during the experiment process.

Based on the results, C had a significant impact on PEU for both cases while C had an impact on PU in the post-acceptance model. In a similar study, Yadegaridehkordi et al. (2019) found that students" perceptions of collaboration towards online collaborative learning tools had an impact on their PU and PEU. Therefore, collaboration was positively associated with the intention to use web 2.0 technologies in future teaching which

was mediated by PEU and PU at the end of the process. Moreover, its impact on PU and PEU was increased according to the coefficient values from the pre to post-acceptance models. Especially, the significant effect of C on PU after the experiment can be explained that as teacher candidates used the collaboration and interaction features of the web 2.0 technologies, their perception of usefulness would increase (Baas, 2010). For example, teacher candidates studied topics such as instructional materials, design principles of these materials, effective design with web 2.0 technologies through collaborative activities such as accessing information, sharing it with groupmates, discussing the topic with groupmates and instructor, and communicating with groupmates and instructor whenever they want. Therefore, they gained experience in the design of instructional materials with web 2.0 technologies during collaborative learning. In other words, their perceptions toward collaborative activities tended to enhance their productivity and become helpful in using the web 2.0 tool easily. On the other hand, the significant effect of C on PEU in both cases can be explained as teacher candidates could have experiences about collaborative learning with a technological tool. Thus, this belief may affect their perception that the use of web 2.0 technologies is free of effort. Additionally, the collaboration continued to affect the PEU with a more powerful coefficient value at the end of the process.

Regarding the research findings, this study has offered some implications for theory and practice. First, this study proposed a model for understanding the determinants of the teacher candidates" intentions to use web 2.0 technologies before and after the collaborative learning. In addition to the cross-sectional methods used widely in the technology acceptance studies, this study employed the experimental design to observe changes of intention to use. This method was used because any trainings related to the technology that users take might change their intention (Davis, Bagozzi, & Warshaw, 1989). In this regard, the proposed model has become helpful in explaining more factors that influence teacher candidates" intention to use web 2.0 technologies in the post-acceptance model. On the other hand, the effect of collaborative learning on teacher candidates" intention to use web 2.0 technologies was examined with extending TAM in the current study. Therefore, an application of extended TAM can offer practical value for examining teacher candidates" or teachers" intention to use technology in the collaborative learning environment.

For practice, to increase teacher candidates" intentions to use web 2.0 technologies, collaborative learning activities can be used in the learning environments. First, teacher candidates learn how to use them in education, participate in the learning process more actively, and interact with the environment. Then they may perceive that the web 2.0 tools improve their teaching performance. Second, hands-on projects and meaningful learning activities can affect their perceived usefulness and attitudes. Third, thanks to collaborative learning activities with technology, teacher candidates may learn how to operate a web 2.0 tool easily and in turn, this may affect their intentions.

This research has some limitations. First, this study was carried out with a small sample. Future research can be conducted with larger groups to generalize the research findings. Moreover, two groups can be selected and the effect of the traditional paradigm and active learning paradigm on users" intentions can be investigated. Second, while the participants of the study were in the second year at their departments, a similar study can be conducted with teacher candidates who are in 3rd or 4th year at their departments. Third, teacher candidates used Google Drive, Bubbl.us, Canva, and Google Forms. A future study can incorporate synchronous tools such as Google Hangouts and Skype, social learning management systems such as environment Edmodo, Facebook, and wiki for collaboration, and other instructional material design tools. Finally, TAM was extended with the collaboration construct. In further studies, factors that may influence intention such as subjective norms, self-efficacy, and perceived enjoyment can be added to TAM to get a holistic view.

Conclusion

This study described teacher candidates" intention to use web 2.0 technologies for future teaching over the collaborative learning process with the help of extended TAM. The study was one of the first studies about the related topic that monitor changes in intentions of teacher candidates. The proposed model indicated reliable and valid results. From this aspect, this study made a contribution to technology acceptance literature by the development of intention with the experimental design. Moreover, this study made a valuable contribution for the practice that ICT-supported collaborative learning environments can be used for improving teacher candidates" or teachers" intentions to use web 2.0 technologies for teaching in any course or training session.

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