Exploring Factors that Predict Preservice Teachers' Intentions to Use Web 2.0 Technologies Using Decomposed Theory of Planned Behavior

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Abstract

*This study investigated factors that predict preservice teachers' intentions to use Web 2.0 technologies in their future classrooms. The researchers used a mixed-methods research design and collected qualitative interview data (*n *= 7) to triangulate quantitative survey data (*n *= 286). Results indicate that positive attitudes and perceptions of perceived usefulness are significant predictors of preservice teachers' intentions to use Web 2.0 technologies. Additional findings indicate that preservice teachers intend to use blogs, wikis, and social networking in their future classrooms to improve student learning, student–student and student–teacher interaction, collaborative learning, student writing ability, and sharing content knowledge. Although preservice teachers intend to use Web 2.0 technologies due to these pedagogical benefits, they believe that successful use of Web 2.0 depends on the meaningful integration of these technologies with the subject being taught, learning goals, and age level of their students. This study has implications for teacher educators who are preparing preservice teachers to use Web 2.0 technologies in their classrooms. (Keywords: Web 2.0, educational technology, technology integration, preservice teachers' intentions, Decomposed Theory of Planned Behavior)*

Web 2.0 technologies (wikis, blogs, social networking, etc.) are becoming increasingly prominent in education, because of the need for students to develop 21st century skills as well as the potential value of these technologies for teaching and learning. These social interfaces of Web 2.0 technologies provide new ways for people to collaborate, interact, communicate, co-create, and share ideas and knowledge (Hartshorne & Ajjan, 2009; Shihab, 2008). According to Conole and McAndrew (2010), the affordances of Web 2.0 technologies are aligned with the concepts of good pedagogy of socioconstructivist approaches, which is why these technologies are very appealing for teachers and learners. By using Web 2.0 technologies, students are no longer passive recipients of information, but rather are co-creators of knowledge through the exchange of information and experiences (Orehovacki, Bubas, & Konecki, 2009).

The successful integration of Web 2.0 technologies, however, depends on teachers' ability to create socially active learning environments that encourage cooperative interaction, collaborative learning, and group work (Nelson, Christopher, & Mims, 2009). In recognition of this need, the National Educational Technology Standards for Teachers (NETS•T) emphasizes the need for preservice teachers to gain the fundamental knowledge, skills, and attitudes necessary to incorporate contemporary tools and resources into the learning process (ISTE, 2008). Additionally, the standards outline the expectation for teachers to "model and facilitate effective use of current and emerging digital tools to locate, analyze, evaluate, and use information resources to support research and learning" (Standard 3d).

Regardless of the fact that the current generation of preservice teachers is savvy with social and communication technologies, recent studies suggest that they are not prepared to integrate Web 2.0 technologies into their classrooms (Gill & Dalgarno, 2008; Lei, 2009). Anderson and Maninger (2007) argue that, because the ultimate goal of any technology program is to influence preservice teachers' abilities and intentions to teach with technology in their classrooms, it is useful to first consider factors associated with the instructional use of technology. Thus, to help teacher education programs better prepare preservice teachers for 21st century classrooms, it is crucial to understand the factors contributing to or impeding preservice teachers' intentions to use Web 2.0 technologies.

Literature Review

Preservice Teachers' Intentions to Use Technology

Research on the adoption of information technology indicates the importance of intentions in predicting actual use (Ajzen, 1991; Taylor & Todd, 1995; Venkatesh, Morris, Davis, & Davis, 2003). *Intention* is defined as an anticipated outcome that is expected based on a person's planned actions or behavior (Ajzen, 2001). Preservice teachers' positive intentions toward using technologies have been proven to be a major predictor for the future use and successful integration in their classrooms (Myers & Halpin, 2002; Yushau, 2006). For this reason, a number of studies have explored influential factors that explain preservice teachers' acceptance of and intentions to use technology.

Many researchers have reported that perceived usefulness and ease of use were the most significant factors affecting preservice teachers' intentions to use technology (Ma, Andersson, & Streith, 2005; Sadaf, Newby, & Ertmer, 2012; Smarkola, 2007; Teo, Lee, & Chai, 2008; Yuen & Ma, 2002). Some studies found self-efficacy to be a significant determinant of intentions and use (Anderson & Maninger, 2007; Chen, 2010; Giallamas & Nikolopoulou, 2010; Teo, 2009). For instance, Anderson and Maninger (2007) explored the factors that best predicted preservice teachers' intentions to use a variety of software and

found value beliefs and self-efficacy to be significant predictors. Other studies have reported that subjective norms (i.e., person's behavior influenced by other people), and facilitative conditions (i.e., available resources and technology) affect preservice teachers' intentions to use computers (Teo, 2009). Although these studies have explored factors influencing preservice teachers' technology integration efforts in different contexts and related to different technologies, little research has examined the potential factors that determine preservice teachers' intentions to use Web 2.0 technologies in schools.

Preservice Teachers' Views and Intentions about Web 2.0 Use

The current generation of students entering the field of education is savvy with social and communications technologies (Lei, 2009). Access to the Internet and digital technologies has already exerted a major influence on these students' ways of thinking, communicating, and learning (Oblinger & Oblinger, 2005; Prensky, 2001). That is, current preservice teachers are very good at communicating and using online interaction technologies. However, there is concern as to whether these preservice teachers are prepared to integrate these technologies into effective lessons for their students (Lei, 2009; Ma et al., 2005).

Relatively few studies have explored preservice teachers' views and intentions to integrate Web 2.0 technologies within the classroom environment. One such example is a study by Coutinho (2008) that verified the importance of providing preservice teachers with Web 2.0 experiences to learn how to integrate technologies within their future classrooms. In this study, preservice teachers explored different Web 2.0 technologies—blogs, wikis, and Google Page Creator—with different pedagogical goals. One hundred nine preservice teachers who attended Educational Technology programs in the school years 2006–2007 and 2007–2008 participated in the study. The results of Coutinho's study showed that after the program, participants had positive intentions to use these technologies for pedagogical purposes.

Coutinho's (2008) study shed some light on preservice teachers' intentions, but it was more focused on how preservice teachers used Web 2.0 technologies during the teacher education program. The determinants of preservice intentions are not known. Furthermore, although preservice teachers may intend to use Web 2.0 technologies, it is not clear how they perceive the pedagogical benefits of Web 2.0 technologies in their future classrooms. Use of a well-established framework (e.g., Decomposed Theory of Planned Behavior) might shed in-depth insight into preservice teachers' intentions and discover determinant factors of those intentions.

Purpose of Study

The purpose of this study was two-fold: to determine factors influencing preservice teachers' intentions to use Web 2.0 technologies in their future classrooms, and to explore preservice teachers' perceptions of

the pedagogical benefits of using Web 2.0 technologies to enhance student learning. The specific research questions included:

1. What factors best predict preservice teachers' intentions to use Web 2.0 technologies in their future classrooms? How do preservice teachers describe the factors that predict their intentions to use Web 2.0 technologies in their future classrooms?
2. What are preservice teachers' perceptions of the pedagogical benefits of using Web 2.0 technologies in their future classrooms? How do preservice teachers describe their perceptions of Web 2.0 technologies as pedagogical tools?

Theoretical Framework

In an effort to understand preservice teachers' intentions to use Web 2.0 technologies, we chose the Decomposed Theory of Planned Behavior (DTPB) as a theoretical framework (Taylor & Todd, 1995). The DTPB extends the theory of planned behavior (TPB), which focuses on the direct measures of attitude, subjective norms, and perceived behavior control to predict intention and in turn predict one's behavior (Ajzen, 1991). The DTPB explores attitudes, subjective norms, and perceived behavioral control by decomposing them into belief-based indirect measures. For example, *perceived usefulness, ease of use*, and *compatibility* explain attitudes; *peer influence* and *superior influence* explain subjective norms; and *self-efficacy* and *facilitative conditions* explain perceived behavior control. Taylor and Todd suggested that DTPB provides increased explanatory power and a more precise understanding of the behavior. Moreover, it facilitates a more focused examination of the relationship among factors that influence the adoption and use of new technologies.

The DTPB model is a widely used and validated model for predicting behavior intentions from attitudes, subjective norms, and perceived behavior control in both information technology and education studies (Taylor & Todd, 1995). As such, the DTPB provides a comprehensive way to understand how an individual's attitudes, subjective norms, and perceived behavioral control can influence his or her intentions to use Web 2.0 technologies (Ajjan & Hartshone, 2008). Several studies have shown the predictive power of DTPB due to the multidimensionality of its components (Ajjan & Hartshorne, 2008; Hartshorne & Ajjan, 2009; Smorkola, 2008; Taylor & Todd, 1995). Taylor and Todd suggested that researchers should consider using the DTPB if they are looking for more comprehensive perceptions of intentions. Hence, we selected this theoretical model to explore the intentions of preservice teachers to use Web 2.0 technologies in their future classrooms.

Research Hypotheses

Figure 1 presents the theoretical rationale for the causal relationship of the research model.

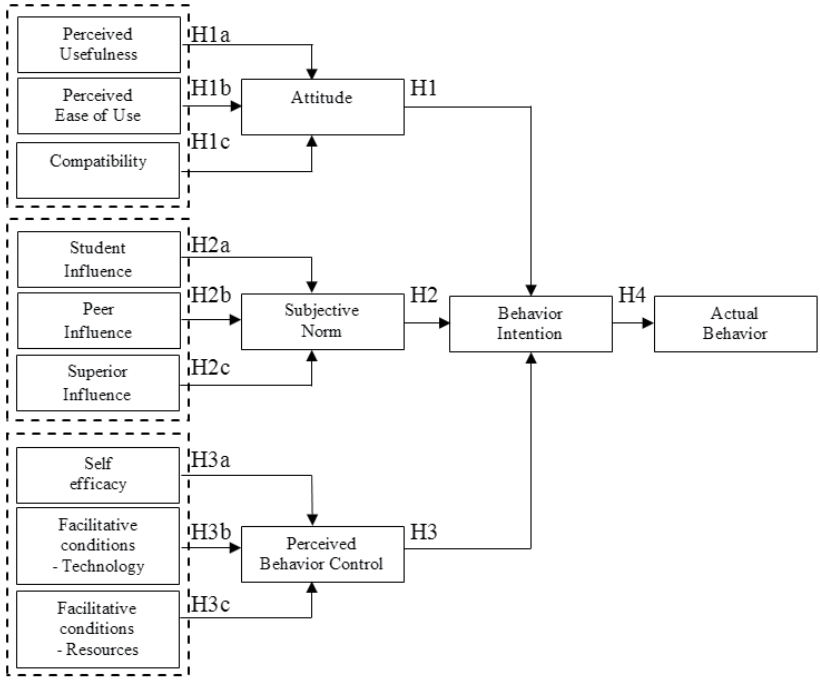

Figure 1. Research framework for preservice teachers' intentions to use Web 2.0 technologies based on the Decomposed Theory of Planned Behavior (Taylor and Todd, 1995).

Attitude

Attitude is defined as an individual's feelings about performing certain behaviors (Ajzen, 1991). In this study, *attitude* refers to the preservice teachers' feelings about using Web 2.0 technologies in their future classrooms. Past research has found a strong relationship between teachers' positive attitudes and behavioral intentions to use computer technologies (Sadaf et al., 2012; Teo, 2009; Teo, et al., 2008). Therefore, it is expected that preservice teachers' favorable attitudes toward Web 2.0 will be positively related to their intentions to use Web 2.0 technologies. With regard to Web 2.0 use, the present study decomposes attitude into perceived usefulness, perceived ease of use, and compatibility (Taylor & Todd, 1995).

In this study, *perceived usefulness* is defined as the extent to which preservice teachers believe that using Web 2.0 technology will help them perform their jobs better as well as help students to achieve learning goals in the classroom. In contrast, *perceived ease of use* is defined as the extent to which preservice teachers believe using Web 2.0 tools would be free of effort. Technologies cannot improve teachers' job performance if they perceive technology as being too difficult to use. Past research shows that perceived usefulness (Ma et al., 2005; Smarkola, 2007; Teo, et al., 2008) and perceived ease of use affect preservice teachers' intention to use technology (Yuen & Ma, 2002; Smarkola, 2007).

Compatibility describes the degree to which technology adoption fits the task, values, and needs of the user (Roger, 2003). In this study, *perceived compatibility* is defined as the extent to which preservice teachers believe that using Web 2.0 technologies would be compatible with the subject that they will be teaching in their future classrooms. As a component of attitudes, compatibility of Web 2.0 tools with preservice teachers' needs is expected to influence behavioral intentions (Taylor & Todd, 1995).

With a higher perceived usefulness, ease of use, and compatibility, it is likely that the attitude toward using the technology would also become positive (Ajjan & Hartshorne, 2008). Accordingly, we propose the following hypotheses:

- **H1:** Attitudes of preservice teachers toward the use of Web 2.0 technologies positively affects their behavioral intentions.
- **H1a:** Perceived usefulness positively affects attitudes to use Web 2.0 technologies.
- **H1b:** Perceived ease of use positively affects attitudes to use Web 2.0 technologies.
- **H1c:** Perceived compatibility positively affects attitudes to use Web 2.0 technologies.

Subjective Norms

Subjective norms describe a person's perceptions of whether other people believe s/he should or should not perform a particular behavior (Ajzen, 1991). Within an educational environment, teachers' decisions to integrate technology might be affected by the opinions and suggestions of other people who are important to them (Ma et al., 2005). This study decomposes subjective norms into three groups: superiors (administrators), peers (colleagues), and students. In this study, the subjective norms are based on the assumption that administrators and colleagues might feel that the adoption of Web 2.0 technology improves students' learning (Ajjan & Hartshorne, 2008). Similarly, students also influence the adoption of technology because they are comfortable using it and might expect its integration into their classroom environment (Sadaf, et al., 2012; Shihab, 2008). Prior studies have found subjective norms to be a key factor affecting teachers' intentions to use technology (Sugar, Crawly, & Fine, 2004; Teo, 2009). It is expected that the subjective norms of preservice teachers are positively related to their behavior intentions. Therefore, we propose the following hypotheses:

- **H2:** The subjective norms of preservice teachers toward the use of Web 2.0 technologies positively affect their behavioral intentions.
- **H2a:** Superiors influence to use Web 2.0 technologies positively affects the subjective norms of preservice teachers.
- **H2b:** Peer influence to use Web 2.0 technologies positively affects the subjective norms of preservice teachers.

- **H2c:** Student influence to use Web 2.0 technologies positively affects the subjective norms of preservice teachers.

Perceived Behavioral Control

Perceived behavioral control refers to people's perception of the ease or difficulty of performing a behavior (Ajzen, 1991). Teachers with self-assured skills and required available resources are inclined to adopt innovative technologies (Ertmer, 2005; Teo, 2009; Yushua, 2006). Lei (2009) found that many preservice teachers tend to have positive attitudes toward technology, yet they do not consider themselves competent to teach with it. Intentions to use technology will be greater to the extent that the preservice teacher perceived that he/she has control over the use of Web 2.0 technologies in future classrooms. In this study, perceived behavioral control is decomposed into self-efficacy and the facilitative conditions of both technology and other resources (Taylor & Todd, 1995). Self-efficacy is defined as the perception of how well one can perform a behavior (Bandura, 1982). This study describes preservice teachers' self-efficacy as their perceptions of their abilities to use Web 2.0 tools to supplement their in-class teaching and student learning. A teacher's computer self-efficacy has a positive impact on technology acceptance and is the basic determinant of behavioral intentions and usage (Anderson & Maninger, 2007). Facilitative conditions refer to environmental factors that influence an individual's desire to perform a task (Teo, et al., 2008). Examples of such factors are access to software and hardware as well as time and money needed to use technology. Teachers will perceive greater control if they have access to required resources such as computers and the Internet to use Web 2.0 technologies in a classroom environment. Research shows that fewer obstacles can engender a feeling of greater control and in turn positively affect intentions to use technology (Taylor & Todd, 1995). Thus, we propose the following hypotheses:

- **H3:** The perceived behavioral control of preservice teachers to use Web 2.0 technologies positively affects behavioral intentions.
- **H3a:** Preservice teachers' self-efficacy of using Web 2.0 technologies positively affects perceived behavioral control.
- **H3b:** Facilitating technology conditions positively affect preservice teachers' perceived behavioral control.
- **H3c**: Facilitating resource conditions positively affect preservice teachers' perceived behavioral control.

Behavioral Intention

In this study, behavioral intention is concerned with motivational factors related to preservice teachers' intentions to use Web 2.0 tools in future classrooms. Ajzen (1991) suggested that behavioral intention is the most important factor in predicting the decision to take a specific action. Given this

close relationship between intention and behavior, past studies have used behavioral intention to predict specific behavior (Ajjan & Hartshorne, 2008; Hartshorne &Ajjan, 2009). It is expected that there is a positive relationship between intention and the actual behavior of preservice teachers. Therefore, we propose the following hypothesis:

H4: Preservice teachers' behavioral intention to use Web 2.0 positively affects behavior.

Methods

Research Design

We used a mixed-methods research design to examine students' intentions to use Web 2.0 technologies in their future classrooms. Specifically, this study used the convergence triangular mixed-methods design, in which we collected different but complementary data to validate and expand quantitative results with qualitative data (Creswell & Clark, 2007).

Context

The required course, composed of a 1-hour large lecture and a 2-hour lab, prepares preservice teachers to integrate technology tools within their future classrooms. As part of the course, preservice teachers worked on a 5-week project about educational uses of specific Web 2.0 technologies (e.g., Facebook, PBWiki, Wordpress, etc.). Preservice teachers worked in teams of six to eight students to explore the assigned Web 2.0 technology and created instructional materials explaining how one could use it within a classroom environment. The finished project consisted of a collaboratively written wiki chapter of a Web 2.0 application, including examples of its use, training materials on how to use it, and educational materials to inform others of its potential. Additionally, preservice teachers created multiple content lesson plans for each of the elementary, secondary, and postsecondary areas. At the end of the project, teams publically presented their Web 2.0 applications and demonstrated how they can be used in the classroom (detailed project procedures were reported elsewhere; see Newby, Ertmer, & Kenney, 2011).

Participants

The sample for this study included preservice teachers enrolled in an educational technology course at a Midwestern university during spring 2010 semester. Of total enrollment (n = 297), 286 completed the online postcourse survey (response rate of 96%). Among these 286 participants, 196 were females (68 %) and 90 were males (32%). The majority (90%) of the participants were 16–21 years of age, 16 (6%) were 22–27 years old, and 11 (4%) were above 28 years of age. Further, 153 (53%) were freshmen, 91 (32%) were sophomores, 28 (10%) juniors, 11 (4%) were seniors, and 3 (1%)

were graduates. Most of the participants were White Americans (90%), and the remaining students were Hispanic/Latino (4%), African American (1%), and Asian (2%). Three percent chose not to identify their race/ethnicity. The majority of the preservice teachers (64%) rated themselves as being very comfortable with computers, 34% rated themselves as fairly comfortable, and 2% rated themselves as a little comfortable.

We used a purposive sampling method to choose participants for one-on-one interviews, based on the survey responses. Criteria for selection included representation from different majors and different grade level interests to understand common perceptions about the use of Web 2.0 use from different perspectives. We selected seven participants—three males and four females, who represented an equal number within each criterion—for final interviews.

Research Instruments and Data Collection

The survey instrument consisted of three sections (see Appendix, pp. 191–195): (a) preservice teachers' attitudes toward Web 2.0 technology integration, (b) DTPB scale, and (c) demographic items. We partially adapted the first two sections of the survey from a previous study done by Hartshorne and Ajjan (2009), who used the survey to exaine student decisions to adopt Web 2.0 technologies. Because the population for the current study is preservice teachers, we modified the wording of many survey items to reflect the population. For example, we modified the statement, "I feel that using Web 2.0 will help me learn more about the subject" to "I feel that using Web 2.0 will help my students learn more about the subject."

The first section of the survey included five statements about participants' views and intentions to use Web 2.0 tools, participants' levels of proficiency with Web 2.0 technologies, actual use, perceptions of pedagogical advantages, and the Web 2.0 technologies that they intended to use in their future classrooms. A sample question was: "What do you view as the advantages of using Web 2.0 technologies (such as wikis, blogs, or Facebook) to enhance student learning?" Section two consisted of modified items of the DTPB scale with a series of 7-point Likert-scale responses (strongly agree to strongly disagree) to examine factors that influence preservice teachers' intentions to use Web 2.0 technologies in their future classrooms. Items focused on perceptions of actual usage/behavior (e.g., "I believe that I could communicate to others the consequences of using Web 2.0 in the classroom"), behavioral intention (e.g., "I plan to use Web 2.0 technologies in my future classroom"), perceived behavioral control (e.g., "Using the Web 2.0 technologies is within my control"), attitude (e.g., "Web 2.0 will be useful in my teaching"), and subjective norms (e.g., "My students will think that I should use Web 2.0 technologies in the classroom"). The third section of the survey included seven categorical response-type items to determine the general demographics of the participants (gender, age, etc.). Because the

population of the current study is different from the population used in the original study, we used Cronbach's alpha to assess the internal consistency reliability analysis of the instrument. The resulting values ranged from .83 to .96, which is above acceptable reliability measures of .70 for exploratory research (Nunnally, 1978). We administered the survey at the end of the Web 2.0 project, and it took approximately 10–15 minutes to complete.

We developed the interview questions based on the Web 2.0 attitude and the DTPB constructs to further explore teachers' survey results and gain additional insights into their responses. Sample questions included: "What do you think of using Web 2.0 technologies within a classroom environment?" and "Would you use Web 2.0 tools in your future classrooms? Why or why not?" We interviewed participants after the conclusion of the course Web 2.0 project. We audio taped and transcribed the interviews, which lasted approximately 15–20 minutes.

Data Analysis

To answer the first research question, we analyzed the DTPB results using path analysis to test the research hypothesis related to determining factors and to estimate the degree of the linkage between variables that determine intention to adopt Web 2.0 technologies. We used the alpha level of 0.05 to evaluate statistical significance. Path analysis is an advanced statistical method used to discover the relative effects of dependent and independent variables (Allen 1997). We used path analysis because it allows the researcher to postulate the relationship among a set of variables using a theory and to show the strength of relationships between variables to interpret findings (Ajjan & Hartshorne, 2008; Klem, 1995). We analyzed the data using Statistical Package for Social Sciences software (SPSS) with regression equations individually fitted on each path. For the second research question, we analyzed results from the attitude scale data using frequencies and percentages of responses to examine preservice teachers' perceptions of the benefits of using Web 2.0 technologies.

We analyzed all open-ended survey responses and interview data using Miles and Huberman's (1994) constant comparative method. First, we coded the data by segmenting and assigning labels to the text passages. Then we categorized similar codes into the DTPB factors and developed themes. Once we had coded all of the transcripts, we then re-analyzed each category to determine the relationships between the codes and to identify the themes that provide further explanations related to DTPB factors. We merged the qualitative and quantitative data during the results to help further explain the quantitative results produced in the study.

Results

The purpose of this study was to (a) determine factors that influencing preservice teachers' intentions to use Web 2.0 technologies in their future classrooms

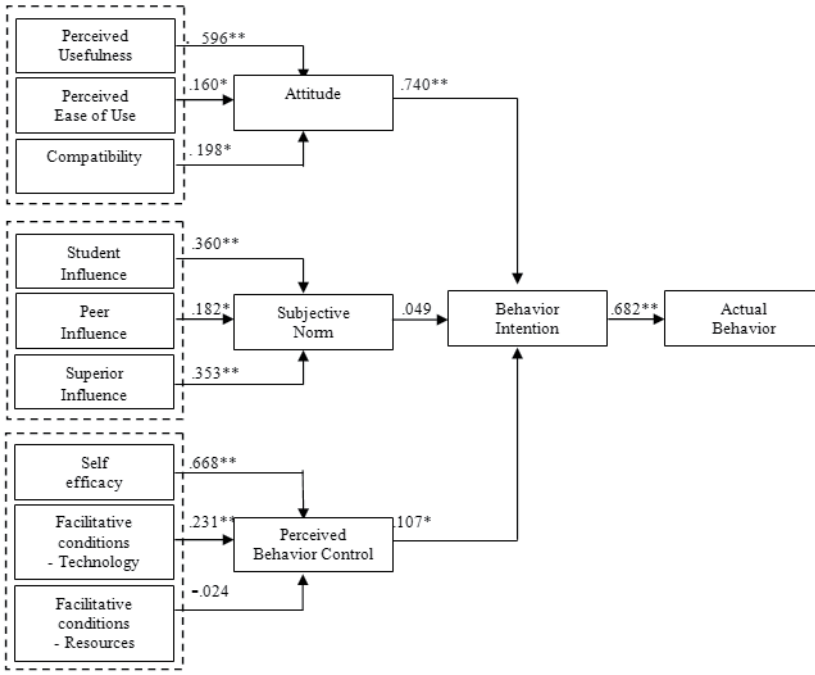

Figure 2. Path analysis of factors that influence preservice teachers' intentions to use Web 2.0 technologies in the classroom. (*$p < 0.05$ **$p < 0.01$ *** $p < 0.001$)

and (b) explore preservice teachers' perceptions of the pedagogical benefits of using Web 2.0 technologies to supplement their students' learning.

Factors Predicting Preservice Teachers' Intentions to Use Web 2.0 Technologies

The results of this study showed that the DTPB is useful for explaining as well as predicting variance in the preservice teachers' intentions to use Web 2.0 technologies in future classrooms. Research hypotheses findings (see Figure 2) are presented using the results of the path analysis (see Table 1, p. 182).

Behavioral Intention

Regression results confirmed that the three factors combined—attitude, subjective norm, and perceived behavioral control—explained a significant variance (71.5%) in behavioral intention (adjusted R^2). Path analysis results indicate that two factors, attitude ($\beta = 0.740$, $t = 15.467$) and perceived behavioral control ($\beta = 0.107$, $t = 2.494$) had a significant effect on behavioral intention, with attitude having the greatest effect. Thus, research hypotheses 1 and 3 are confirmed. In contrast, subjective norm ($\beta = 0.049$, $t = 0.990$) had no significant effect on behavioral intention; therefore, research hypothesis 2 was not confirmed.

Table 1. Path Analysis of Factors That Influence Preservice Teachers' Intentions to Use Web 2.0 Technologies in the Classroom

Equation	R2 (adjusted R2)	Beta (t-scores)*
Behavior (B)	.707 (.706)	
B = BI		
BI		.682 (15.719)***
Behavior intention (BI)	.718 (.715)	
BI = A + SN + PBC		
A		.740(15.467)****
SN		.049(0.990)
PBC		.107(2.494)**
Attitude (A)	.785 (.783)	
A= PU + EOU + C		
PU		.596 (11.458)***
EAU		.160 (3.075)**
C		.198 (4.940)***
Subjective norm (SN)	.686 (.683)	
SN = PI + SUPI + SI		
PI		.182 (2.967)**
SUPI		.353 (6.485)***
SI		.360 (5.382)***
Perceived behavior control (PBC)	.626 (.622)	
PBC = SE+FRC + FTC		
SE		.668(12.898)***
FRC		-.024 (-.385)
FTC		.231 (4.636)***

Notes. * Figures shown are beta coefficients, with t-values in parentheses. $^{**}p < 0.05$ $^{***}p < 0.01$ $^{****}p < 0.001$.

B=behavior, BI=behavior intention, A= Attitude, PU=perceived usefulness, EAU=ease of use, C=compatibility, SN= subjective norm, PI=peer influence, SUPI= superior influence, SI=student influence, PBC=perceived behavior control, SE=self efficacy, FRC=facilitative resource conditions, FTC=facilitative technology conditions.

Based on the interview and open-ended survey data, preservice teachers showed positive attitudes toward their intentions to use Web 2.0 technologies in their future classrooms. For example, one survey participant reported, "I would like to incorporate Web 2.0 technologies within my classroom because I think they are a great way to communicate in the class and get students more involved and interact with each other." Similarly, another participant said, "I think that it would be a great way for the students to use technology and advance in their learning."

Behavior

Research hypothesis 4 states that preservice teachers' behavioral intention to use Web 2.0 positively affects behavior. Examining the path analysis results, behavioral intention ($\beta = 0.682$, $t = 15.719$) had a significant effect on actual behavior, and the behavior equation addresses 70.6% of the variance (adjusted

R^2). Therefore, this study confirmed research hypothesis 4. This suggests that preservice teachers' intention to use Web 2.0 technologies is a predictor of actual use in their future classroom.

Attitude

Regression results confirmed that the three factors combined—perceived usefulness, perceived ease of use, and perceived compatibility—explained a significant variance (78.3%) in attitude (adjusted R^2). Examining the path analysis results, perceived usefulness ($\beta = 0.596$, $t = 11.458$), ease of use ($\beta = 0.160$, $t = 3.075$) and compatibility ($\beta = 0.198$, $t = 4.940$) of Web 2.0 technologies with existing technologies had significant effects on attitudes toward the of use Web 2.0 technologies. Thus, the results of this study combined research hypotheses 1a, 1b, and 1c.

Interview data supported perceived usefulness as an important reason for preservice teachers' intentions to use Web 2.0 technologies in their future classrooms. Participants described how Web 2.0 technologies would be useful for student learning, engagement, motivation, and varied learning experiences. All seven interview participants mentioned that they will use Web 2.0 in the classroom due to its positive impact on student learning. When asked why they intend to use Web 2.0 technologies in their future classrooms, one of the participants responded, "I would use Web 2.0 because it provides a variety of different ways for students to learn. Some students are visual learners and some are auditory learners. I think by using Web 2.0 technologies you can have different forms of learning that can engage more students."

Another participant stated, "I definitely think that if the students could be excited about using a new technology like this [Web 2.0], it could definitely help in motivation and if they are motivated they can definitely do better in class."

Although preservice teachers perceived Web 2.0 technologies to be useful for student learning, they also noted that "usefulness" depends on the content they were teaching, learning goals, and their students' age level. For example, one participant said, "It really depends on what subject you are teaching. It would be hard to incorporate wiki to a math class." Another noted, "If there were specific goals that could be met using Web 2.0 technology, then it is a good idea." Another commented, "I can see them being good for older grades, but not so much for elementary aged students." This implies that, in addition to the benefits of using Web 2.0 technologies, preservice teachers are aware of the context of meaningful integration.

Subjective Norm

Regression results confirmed that the three factors—student influence ($\beta = 0.360$, $t = 5.382$), peer influence ($\beta = 0.182$, $t = 2.967$), and superior influence ($\beta = 0.353$, $t = 6.485$)—jointly explained a significant variance (68.3%) in the subjective norm (adjusted R^2). Therefore, the results of this study confirmed research hypotheses 2a, 2b, and 2c. However,

individual determinants of student influence had the greatest effect on subjective norm.

During the interviews, students' influence also emerged as an important consideration among the preservice teachers when describing their intentions to integrate Web 2.0 into their teaching. Five of seven preservice teachers thought that using Web 2.0 technologies will enable them to be more connected to the students because, according to one participant, "that's what kids are used to, you know, it's more comfortable for them to use those kind of things [Web 2.0 technologies] so I think it would be easier and they would be more excited about learning." Another participant said, "Students live on Facebook and they live on the computer. It's just so natural for them. So I feel like we are connected to future generations more than giving the lecture for 25 minutes."

Perceived Behavioral Control

Regression results showed that the three factors combined—facilitating resources conditions, facilitating technology conditions and self-efficacy—explained a significant variance (62.2%) in perceived behavioral control (adjusted R^2). Examining the path analysis results, self-efficacy ($\beta = 0.668$, $t = 12.898$) had the most significant effect on perceived behavioral control. Thus, the results of this study confirmed research hypotheses 3a. Additionally, research hypotheses 3b and 3c state that facilitating technology conditions and facilitating resource conditions positively affect preservice teachers' perceived behavioral control. Although facilitating technology conditions ($\beta = 0.231$, $t = 04.636$) had a significant effect, facilitating resource conditions ($\beta = -0.024$, $t = -.385$) had a negative effect on perceived behavioral control. The results of this study confirmed research hypothesis 3b and failed to confirm research hypothesis 3c.

The interview data revealed that all seven participants felt very comfortable using Web 2.0 technologies. When asked about their skills and knowledge related to Web 2.0 technologies, one of the participants reported that Web 2.0 "is very easy to learn and I can definitely share my skills. Because I do like technology, I think I would try incorporating it as often as I could." Preservice teachers not only believed that they can use Web 2.0 technologies on their own, but they also thought that they have enough knowledge to be able to use it with the students. For instance, one participant mentioned, "They are pretty easy to use and straightforward to explain to students. So I think the students wouldn't have a problem figuring out how to use it."

Although preservice teachers felt very confident using Web 2.0 technologies, they seemed less confident in their abilities to integrate technology into their lessons. As one participant said, "I might use a little bit more effort just because we have to come up with new ideas that aren't already out there." Similarly, another participant mentioned, "I think I do have the knowledge

Table 2. Preservice Teachers' Perceptions of the Pedagogical Benefits of Web 2.0 Technologies

	Blogs *n* (%)	Wikis *n* (%)	Social Networking *n* %)	Social Bookmarking *n* (%)	Instant Messaging/ Chat *n* (%)	Video Chat *n* (%)	Video Sharing *n* (%)
Improve student–teacher interaction	84 (29.4)	39 (13.6)	82 (28.7)	5 (1.7)	31 (10.8)	33 (11.5)	8 (2.8)
Improve student learning	28 (9.8)	181 (63.3)	18 (6.3)	10 (3.5)	3 (1.0)	19 (6.6)	22 (7.7)
Improve student satisfaction with the course	58 (20.3)	69 (24.1)	75 (26.2)	19 (6.6)	7(2.4)	13 (4.5)	37 (12.9)
Improve interaction with other students	32 (11.2)	16 (5.6)	135 (47.2)	13 (4.5)	48 (16.8)	32 (11.2)	4 (1.4)
Improve student grades	39 (13.6)	140 (49.0)	31 (10.8)	32 (11.2)	10 (3.5)	10 (3.5)	11 (3.8)
Improve student writing ability	154 (53.8)	66 (23.1)	16 (5.6)	12 (4.2)	13 (4.5)	1 (.3)	9 (3.1)
Ease of use/share content knowledge	44 (15.4)	109 (38.1)	53 (18.5)	26 (9.1)	17 (5.9)	14 (4.9)	19 (6.6)
Improve critical thinking with collaborative learning	57 (19.9)	108(37.8)	38 (13.3)	20 (7.0)	15 (5.2)	26 (9.1)	16 (5.6)

and skills to use Web 2.0 technologies. But I would probably go to some workshops that are offered to get some more background on it, like what is appropriate in the classroom."

Perceptions of Pedagogical Benefits and Use of Web 2.0 technologies

The second research question examined preservice teachers' perceptions of the benefits of using Web 2.0 technologies in the classroom to supplement student learning. The results showed that the preservice teachers felt that the use of different Web 2.0 technologies could provide students with numerous benefits (see Table 2). Participants viewed wikis as the most useful Web 2.0 application in terms of improving student learning (63%), improving student grades (49%), ease of use/sharing content knowledge (38%), and improving critical thinking with collaborative learning (38%). In terms of improving student writing ability (54%) and improving student-teacher interaction (29%), the preservice teachers viewed blogs as most beneficial. Social networking technologies were perceived to improve interaction with other students (47.2%), improve student-teacher interaction (28.7%), and improve student satisfaction with the course (26%).

Interview and open-ended survey data also revealed preservice teachers' thoughts that Web 2.0 technologies can offer many advantages to students' learning by increasing interaction, communication, improving writing, and extending class time. For example, one preservice teacher stated, "Web 2.0 technologies enhance learning by providing various learning opportunities for students. Students can use them to connect with peers and teachers outside the classroom" Another commented, "I think that blogs are a great way to communicate in the classroom and get students more involved and interacting with each other." Similarly, another one said, "Wikis and blogs

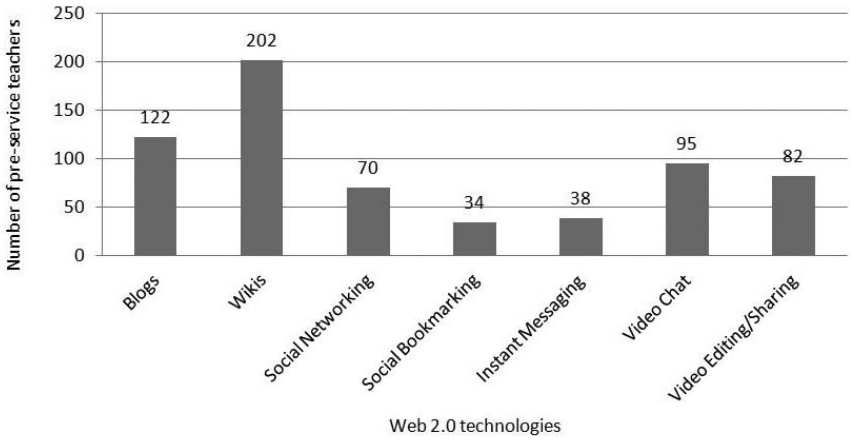

Figure 3. Preservice teachers' intentions to use Web 2.0 technologies in future classrooms.

can be a great tool for compilation and organization of student writings as well as a place to receive feedback and improve upon work."

In terms of preservice teachers' intentions to use Web 2.0 technologies, most of the preservice teachers reported planning to use wikis (n = 202), blogs (n = 122), video chat (n = 95), video editing/sharing (n = 82), and social networking (n = 70) technologies in their future classrooms to supplement their students' learning (see Figure 3, p. 186).

During the interviews, preservice teachers shared their thoughts about how Web 2.0 technologies can be beneficial in certain content areas and their plans to use them within a classroom environment. One participant stated, "For history, if I will do a report, I can make it more web-based. I can create a wiki, have some videos using Web 2.0 technologies, and brainstorming tools to help my students in the developmental stages of the project." Another participant reported, "I think especially with social studies there is a lot of information and there are technologies that can easily convey that information maybe more than I am able to in a 25 minute lecture that would use their [students'] attention." This suggests that although preservice teachers perceived the usefulness of Web 2.0 technologies, their choice of Web 2.0 technologies and intended uses are based on the subject areas they intend to teach.

Discussion

Factors Predicting Preservice Teachers Intentions to Use Web 2.0 Technologies

The path analysis results showed that the preservice teachers' perceived usefulness of Web 2.0 technologies was the strongest determinant of their attitudes. Attitude, in turn, had the strongest effect on their intentions to use Web 2.0 technologies in their future classrooms. This finding is supported by prior studies in predicting preservice teachers' intentions to use different

technologies in different contexts (Ma, et al., 2005; Smorkola, 2008; Teo, 2009; Yuen & Ma, 2002). Interview data supported this finding and further revealed that preservice teachers considered Web 2.0 technologies useful to enhance student learning, engagement, motivation, and varied learning experiences. This perception of the usefulness could be due to preservice teachers' exposure to Web 2.0 technologies during the Web 2.0 project that helped them understand the value of using these technologies in the classroom. Coutinho's (2008) study also found that providing technology-rich experiences with Web 2.0 technologies to preservice teachers had a positive influence on preservice teachers' intentions to use these tools in the classroom.

In addition, among the three groups—administrators, peers, and students—students exerted a stronger effect on preservice teachers' subjective norms. These results imply that preservice teachers' intentions are likely to be influenced by their future students' expectations regarding the use of technology. The interview data further revealed that preservice teachers believe that integrating Web 2.0 technologies will make learning more meaningful and relevant for their students because they are already using these technologies outside of the classroom. This finding is supported by Shihab (2008), who suggested that today's students expect learning to take place using modern digital communication tools. Therefore, Web 2.0 technologies should be integrated into the classroom due to the expectations of digital natives as well as its great potential for teaching and learning.

This study found self-efficacy to be the strong determinant of preservice teachers' perceived behavioral control. Perceived behavioral control, in turn, had the strongest effect on their intentions to use Web 2.0 technologies in their future classrooms. This is corroborated by the findings of previous studies, which showed computer self-efficacy to positively influence teachers' views and intentions to use and integrate computers (Anderson & Maninger, 2007; Giallamas & Nikolopoulou, 2010). The results from preservice teachers' interviews showed that they were very confident and enthusiastic about using Web 2.0 technology in their future classrooms. Although preservice teachers expressed high self-efficacy in using Web 2.0 technologies, their self-efficacy related to integrating Web 2.0 technologies into classroom lessons was low. This might be due to their lack of actual classroom experience or developing lessons that take into account subject matter content, diversity of learners, classroom conditions, and contexts.

Perceptions of Pedagogical Benefits and Use of Web 2.0 Technologies

The results of the study indicate that a majority of the preservice teachers intend to use Web 2.0 technologies in their future classrooms, not only to improve student learning, but also due to many other pedagogical benefits. For example, preservice teachers intend to use blogs, wikis, and social networking in their future classrooms to enhance student learning, students–student and student–teacher interaction, collaborative learning, student writing

ability, and sharing content knowledge. This finding is comparable to other research findings that preservice teachers consider Web 2.0 technologies to have great potential for teaching and learning in the classroom (Coutinho, 2008; Lei, 2009). Although preservice teachers mentioned many benefits, they also noted that successful integration depends on how selected Web 2.0 technologies relate to the content being taught, learning goals, and age level of the students. This implies that, in addition to the benefits of using Web 2.0 technologies, preservice teachers are aware of the context of meaningful integration. This finding diverges from Lei's (2009) results, which showed that preservice teachers did not have the knowledge and skills to integrate technology into teaching. One possible reason for this difference between our results and Lei's might be that preservice teachers in our study worked on a Web 2.0 project that helped them learn how to integrate Web 2.0 technologies within their specific subject areas and age levels they are planning to teach in future classrooms.

Key Findings

This study contributes to the literature in three significant ways. First, this study confirmed the findings from previous research that demonstrated preservice teachers' positive attitude and perceived usefulness are critical factors that can be used to predict their intention to use technology (Ma et al., 2005; Smarkola, 2007; Teo, et al., 2008; Teo, 2009). Second, this study revealed preservice teachers' intentions to use blogs, wikis, and social networking in their future classrooms to improve student learning, students–student and student–teacher interaction, collaborative learning, student writing ability, and sharing content knowledge. Finally, by using a mixed-method approach (a combination of quantitative and qualitative methods), this study has provided teacher educators a complete picture of the factors that influence preservice teachers' intentions to use technology from different dimensions. According to Chen (2010), studying teachers' process of technology adoption requires a multidimensional understanding of a complex process, and it is important to understand teachers' rationale behind their intentions/decisions. Therefore, it is worthwhile to focus on the predicted factors of this study to prepare preservice teachers for successful use of Web 2.0 technologies in their future K–12 classrooms.

Implications for Practice

The results of this study have implications for teacher educators who are preparing preservice teachers to use Web 2.0 technologies in their classrooms. As this study's results showed that positive attitudes and perceptions of perceived usefulness to be the significant predictors of preservice teachers' intentions to use Web 2.0 technologies, this should be the focus in teacher education. Teacher training experiences need to include opportunities for preservice teachers to develop actual lesson plans that integrate Web 2.0 technologies, micro-teach those lessons in teacher education courses, and

reflect on their experiences. This might help improve their attitudes toward, and enhance their perceptions of, the usefulness of Web 2.0 technologies.

Another practical implication from this study relates to the preservice teachers' intentions to use blogs, wikis, and social networking in their future classrooms due to several pedagogical benefits. Teacher educators need to support the progression between preservice teachers' intentions to actual actions by providing opportunities for them to use their own technology-enhanced lesson plans in an actual classroom with real students (Sadaf et al., 2012). This can help them better understand the pedagogical benefits of using Web 2.0 technologies for student-centered learning. Finally, the results of the study showed tha tpreservice teachers' intentions to use Web 2.0 vary according to the learning goals, age level of their students, and the subject area they intend to teach in their future classrooms. Hence, the focus of teacher education programs should not be on teaching "how to use the tool," but rather how to use the tool to teach particular subject matter content according to the age level that a preservice teacher intends to teach. Albion (2008) suggested that "the best way for teachers to learn *about* Web 2.0 may be through learning *with* Web 2.0 as authentic practice that can inform their planning and implementation of learning activities" (p. 21, emphasis added). Teacher technology programs should emphasize the use of subject-specific Web 2.0 technologies and include opportunities for students to appropriately integrate those technologies to help them teach specific subject areas more effectively.

Limitations

This study is limited by its participants, as we asked only preservice teachers who participated in a 5-week project embedded within an introductory educational technology course to participate. Thus, generalizability is limited to preservice teachers in similar courses. Additionally, a total of seven interviewees for the interviews is a small sample size. Therefore, the findings from the interviews should be interpreted carefully. The study is also limited by the fact that it is focused on preservice teachers' intentions and not actual usage of Web 2.0. Although intention has been proven to be a critical predictor of technology use, the intentions of participants might change as they start teaching in schools.

Recommendations for Future Research

Future research can now determine the specific interventions that will help to increase preservice teachers' attitudes and perceived usefulness of Web 2.0 technologies. Additionally, researchers can also examine other populations, such as inservice teachers or teachers who have completed their student teaching experiences and thus have more experience with actual teaching demands. Thus, it might be interesting to examine how experience contributes to the variance in attitude, subjective norm, and perceived behavior control on actual behavior related to the use of Web 2.0 technologies.

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Appendix

Web 2.0 Preservice Teacher Survey

Section I: Web 2.0 Attitude

1. Please list your level of proficiency with the following Web 2.0 applications.

	Never Use	Novice	Competent	Proficient
Blogs (Blogger, WordPress)				
Wikis (Confluence, pbWiki)				
Social Networking (Facebook, MySpace)				
Social Bookmarking (Stixy, Delicious)				
Instant Messaging (MSN Messenger, Yahoo Messenger)				
Video Chat (Skype,TokBox)				
Video Editing/Sharing (Jing, Animoto)				

2. What do you think of using Web 2.0 technologies (e.g. blogs, wikis, Facebook, YouTube, bookmarking tools, etc.) within a classroom environment?

3. To what extent do you use the following Web 2.0 applications to supplement your in-class learning?

	Don't use & don't plan to use	Don't use but plan to use	Use occasionally & plan to use occasionally	Use occasionally & plan to use frequently	Use frequently & plan to keep using frequently
Blogs (Blogger, WordPress)					
Wikis (Confluence, pbWiki)					
Social Networking (Facebook, MySpace)					
Social Bookmarking (Stixy, Delicious)					
Instant Messaging (MSN Messenger, Yahoo Messenger)					
Video Chat (Skype,TokBox)					
Video Editing/Sharing (Jing, Animoto)					

4. What are, in your opinion, the advantages of using each of the following Web 2.0 technologies to supplement students' learning?

	Blogs	Wikis	Social Networking	Social Bookmarking	Instant Messaging	Video Chat	Video sharing/ editing
Improve student–teacher interaction							
Improve student learning							
Improve student satisfaction with the course							
Improve interaction with other students							
Improve student grades							
Improve student writing ability							
Easy to use/share content knowledge							
Improve critical thinking with collaborative learning							

5. Which of these Web 2.0 technologies do you plan to use in your future classroom as a teacher to supplement your students' learning?

   - ❍ Blogs (Blogger, WordPress)
   - ❍ Wikis (Confluence, pbWiki)
   - ❍ Social networking (Facebook, MySpace)
   - ❍ Social bookmarking (Stixy, Delicious)
   - ❍ Instant messaging (MSN Messenger, Yahoo Messenger)
   - ❍ Video chat (Skype,TokBox)
   - ❍ Video editing/sharing (Jing, Animoto)

Section II: DTPB Scale

6. Thinking of the Web 2.0 technologies (e.g., blogs, wikis, Facebook, YouTube, bookmarking tools, etc.), to what extent do you agree or disagree with the following statements?

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
I believe that I could communicate to others the consequences of using Web 2.0 in my future classroom.						
I would have no difficulty explaining why Web 2.0 technologies may or may not be beneficial.						
I plan to use Web 2.0 technologies in my future classroom.						
I intend to use Web 2.0 technologies as soon as I start teaching.						
Web 2.0 will be useful in my teaching.						
The advantages of using Web2.0 outweigh the disadvantages of not using it.						
Using Web 2.0 is a good idea.						
I feel that Web 2.0 will be easy to use.						
I feel that using Web 2.0 will be easy to incorporate in my future classroom.						
I feel that using Web 2.0 will help my students learn more about the subject.						
I feel that using Web 2.0 will improve my students' satisfaction with the course.						
I feel that using Web 2.0 will improve my students' grades.						
I feel that using Web 2.0 will improve students' evaluation.						
To help my students better learn the material, I will incorporate Web 2.0 technologies in my future classroom.						
My peers will be using Web 2.0 technologies in their classrooms.						
My Instructor/TA confirms my ability and knowledge to use Web 2.0 technologies in my future classroom.						
My peers think I will benefit from using Web 2.0 technologies in my future classroom.						
My superiors will think it is important to use Web 2.0 technologies in my classroom.						
My students will think it is important to use Web 2.0 technologies in my classroom.						
Using the Web 2.0 technologies is entirely within my control.						
I have the knowledge and ability to use Web 2.0.						
Peers who influence my behavior would think that I should use Web 2.0 technologies in the classroom.						
Peers who are important to me would think that I should use Web 2.0 technologies in the classroom. My superior, who influences my behavior would think that I should use Web 2.0 technologies in the classroom						
My superior, whom I will report to would think that I should use Web 2.0 technologies in the classroom						
Students who influence my behavior would think that I should use Web 2.0 technologies in the classroom						
Students who are important to me think that I should use Web 2.0 technologies in the classroom						

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Don't Know
Using Web 2.0 technologies are compatible with the way I will teach						
Using Web 2.0 technologies fit well with the way I will teach						
The Web 2.0 technologies will be compatible with the computer I use in the classroom						
I will be able to use Web 2.0 technologies using any computer connected to the Internet						
I would feel comfortable using Web 2.0 technologies						
I could easily use Web 2.0 technologies on my own						
I know enough to use Web 2.0 technologies						

Section III: Demographics

7. Gender:

   - ❍ Male
   - ❍ Female

8. College / Major:

9. Year in College:

   - ❍ Freshman
   - ❍ Sophomore
   - ❍ Junior
   - ❍ Senior
   - ❍ Graduate

10. Age:

    - ❍ 16–21
    - ❍ 22–27
    - ❍ 28–33
    - ❍ 34–40
    - ❍ Over 40

11. Ethnicity:

    - ❍ American Indian, Native American
    - ❍ Asian, Asian American, Pacific Islander
    - ❍ Black, African American
    - ❍ Hispanic, Latino
    - ❍ White, Caucasian, Anglo American
    - ❍ Other
    - ❍ I choose to not provide this information

12. Comfort with computers:

- ❍ Not at all comfortable
- ❍ A little comfortable
- ❍ Fairly comfortable
- ❍ Very comfortable
