

Predicting Teachers' Behavioral Intentions Regarding Web-based Professional Development by the Theory of Planned Behavior

Chia-Pin Kao¹, Kuen-Yi Lin^{2*}, Hui-Min Chien³

¹ Southern Taiwan University of Science and Technology, Tainan, TAIWAN

² National Taiwan Normal University, Taipei City, TAIWAN

³ Cheng Shiu University, Kaohsiung City, TAIWAN

Received 11 June 2017 • Revised 11 December 2017 • Accepted 5 January 2018

ABSTRACT

This study utilized the Theory of Planned Behavior as our basis, while considering important demographic variables such as gender and age, we constructed a comprehensive model of elementary school teachers' behavioral intentions regarding web-based professional development. A survey was conducted among 359 elementary school teachers, and path analysis was used to construct a model of elementary school teachers' behavioral intentions regarding web-based professional development. The following conclusions are made: (1) demographic variables (gender and age) had only indirect effects on teachers' behavioral intentions regarding web-based professional development; age in particular had a negative impact on perceived behavioral control, which in turn negatively influenced such behavioral intentions; (2) the primary factor influencing elementary school teachers' behavioral intentions in this regard was attitude, followed by perceived behavioral control. Based on the above conclusions, we propose specific suggestions for researchers, practitioners, administrators, and professional development specialists.

Keywords: behavioral intentions, elementary school teachers, theory of planned behavior, Web-based professional development

INTRODUCTION

In this era of educational reform, the ability of teachers to utilize web-based professional development to enhance their skills in using and applying technology is a key factor for improving student performance (Carlson & Gadio, 2002; Cengiz, 2015; Hixon & Buckenmeyer, 2009; Sung, Chang, Yu, & Chang, 2009). In recent years, many studies examining professional development for teachers have discussed the appropriate use of the internet in this context (Kao & Tsai, 2009; Kao, Wu, & Tsai, 2011; Chen, Chen, & Tsai, 2009; Chen, Jang, & Chen, 2015), and consequently, the factors influencing teachers' implementation of web-based professional development have become a topic of concern. Teachers' web-based or online professional development mainly refers to internet-based learning opportunities and materials that are provided to teachers, such as education curricula, activities, workshops, resources, and interactions among educators, consultants, peers, and so on (Chen, Chen, & Tsai, 2009; Lavonen, Lattu, Juuti, & Meisalo, 2006; Treacy, Kleiman, & Peterson, 2002).

Professional development plays a critical role in improving teachers' practical teaching abilities and outcomes (Kao, Wu, & Tsai, 2011). However, the curricula provided for teachers in many professional development units are of poor quality; as a result, teachers cannot apply these new curricula or pedagogies in their teaching practice (Borko, 2004) even if they have participated in professional development focused on their use. To bridge this gap, many online professional development curricula are presently available for additional study, providing teachers with timely assistance in solving problems encountered during teaching practice (Dede, Ketelhut, Whitehouse, Breit, & McCloskey, 2006; Kao, Wu, & Tsai, 2011). However, Chen, Chen, and Tsai (2009) examined teachers' views on web-based professional development, and the results of their interviews showed that teachers viewed face-to-face discussion as slightly more advantageous than online synchronous discussion. Although related studies have

Contribution of this paper to the literature

- This study constructs a comprehensive model of elementary school teachers' behavioral intentions regarding web-based professional development.
- This study explores the influence of variables such as elementary school teachers' subjective norms, attitudes, and perceived behavioral control on these intentions.
- This study explores the influence of demographic variables such as elementary school teachers' gender and age on their behavioral intentions regarding web-based professional development.

focused on solving problems caused by the poor quality of the curricula provided in teacher professional development units, further in-depth discussion is needed on the factors influencing teachers' behavioral intentions in the professional development context.

Taken together, the results of the aforementioned studies indicate that teachers' web-based professional development is an important topic. The primary research objective of the current study was to improve teachers' behaviors in relation to web-based professional development. Yuen and Ma (2008) investigated teachers' acceptance of e-learning technology and found that the perceived ease of technology use was the primary factor influencing whether teachers applied the technology in their teaching and that perceived ease of use was in turn affected by teachers' self-efficacy and subjective norms. Kao, Wu, and Tsai (2011) examined the level of motivation among elementary school teachers with regard to web-based professional development and found that it was closely related to their sense of self-efficacy and behavioral beliefs. In other words, elementary school teachers who possessed higher internet efficacy and stronger behavioral beliefs were more willing to participate in web-based professional development.

Although the above studies pointed out the correlation between teachers' self-efficacy and subjective norms on the one hand and their participation in web-based professional development on the other, there have been a few comprehensive investigations of the most effective methods for improving teachers' behaviors and attitudes with respect to web-based professional development. To better examine the factors that enhance such behaviors or generate more positive attitudes towards them, it may be useful to consider the Theory of Planned Behavior model proposed by Ajzen (1991, 2006) and adopted by previous studies to examine the factors influencing teachers' web-based professional development. Within this model, the variables influencing elementary school teachers' behavioral intentions regarding web-based professional development include factors such as subjective norms, attitudes toward web-based professional development, and perceived behavioral control. In addition to these variables, Terras and Ramsay (2012) have pointed out in their study on action learning that although Cheon, Lee, Crooks, and Song (2012) used the Theory of Planned Behavior model proposed by Ajzen (1991) to construct an effective action-learning behavioral model, individual differences among learners, such as gender, age, and other demographic variables, should also be considered. In line with this recommendation, in addition to applying the Theory of Planned Behavior, the present study also included in the model important demographic variables such as the gender and age of elementary school teachers.

Based on the above considerations, the main questions we examined were as follows. (1) What is the influence of demographic variables such as elementary school teachers' gender and age on their behavioral intentions regarding web-based professional development? (2) What is the influence of variables such as elementary school teachers' subjective norms, attitudes, and perceived behavioral control on these intentions?

THEORETICAL FRAMEWORK

This study focused on constructing a theoretical model to represent the dimensions of Taiwanese elementary school teachers' behavioral intentions with regard to web-based professional development, with the aim of exploring the relationships among these dimensions. We identified three elements, namely subjective norms, attitudes, and perceived behavioral control, that are related to behavioral intentions regarding web-based training. Additionally, the demographic variables of gender and age were considered in the proposed model. The relevant literature pertaining to these elements and demographic variables is discussed in the following subsections.

Behavioral Intentions regarding Web-based Professional Development

When we refer to teachers' behavioral intentions regarding web-based professional development, we are primarily referring to their intentions to make use of internet-based learning opportunities for participating in actual professional development activities involving education curricula, activities, workshops, resources, and interactions among educators, consultants, and peers (Chee, Mehrotra, & Ong, 2015; Chen, Chen, & Tsai, 2009; Rasku-Puttonen, Eteläpelto, Lehtonen, Nummala, & Häkkinen, 2004; Treacy, Kleiman, & Peterson, 2002). Previous studies have primarily used the Technology Acceptance Model to explore possible factors influencing teachers'

web-based professional development activities (Kao, Wu, & Tsai, 2011; Yuen & Ma, 2008), but these have not performed a comprehensive investigation specifically targeted at improving teachers' behaviors with respect to web-based professional development. To better examine the influencing factors that improve teachers' web-based professional development behaviors, Ajzen's (1991, 2006) Theory of Planned Behavior was applied in our investigation. Ajzen (1985) proposed the Theory of Planned Behavior as a way of predicting and understanding human behavior in all realms. The theory emphasizes that behavior is determined by individual behavioral intentions, which in turn are determined by factors such as attitudes, subjective norms, and perceived behavioral control, each of which is influenced by external variables. Sugar, Crawley, and Fine (2005) used the Theory of Planned Behavior to study attitudes towards technology. A comparison of their study outcomes with those of previous studies revealed that the model laid out by the Theory of Planned Behavior was a useful tool for identifying individuals' underlying cognitive foundation and their technology use. A study by Lee, Cerreto, and Lee (2010) similarly found that variables such as attitude, subjective norms, and perceived behavioral control were all important factors influencing teachers' decisions with respect to the use of educational technology, lending further support to the Theory of Planned Behavior as an effective explanation for such behaviors. Therefore, we constructed a model of elementary school teachers' behavioral intentions regarding web-based professional development based on the Theory of Planned Behavior, with the aim of exploring factors that might help improve teachers' behaviors with respect to web-based professional development.

Subjective Norms related to Web-based Professional Development

According to Ajzen's (1985, 1991) Theory of Planned Behavior, normative beliefs originate primarily from "subjective norms" formed as a result of socially based encouragement, enticement, pressure, and so forth. Therefore, when elementary school teachers are faced with the need to engage in web-based professional development, one important factor affecting their behavioral intentions is whether they will be subject to influence from their peers or superiors such as education authorities, principals, and school administrators. Hence, the term *subjective norms* was defined as positive support or negative opposition from important reference groups, such as superiors or peers, in relation to elementary school teachers' (prospective) web-based professional development, and the strength of teachers' willingness to comply with these normative beliefs. In a pertinent study, Giannakos and Vlamos (2013) examined the acceptance of educational webcasts as learning tools and found that learners' subjective norms affected their behavioral intentions regarding the use of webcasts. Similarly, Hung and Jeng (2013) discovered that subjective norms had a significant influence on the behavioral intentions of future educational technologists with respect to online learning. These studies indicate a close relationship between subjective norms and behavioral intentions. This relationship warrants further in-depth examination if we are to understand the influence of subjective norms on the behavioral intentions of elementary school teachers regarding web-based professional development; the present study undertakes just such an examination.

Attitudes toward Web-based Professional Development

In the Theory of Planned Behavior as proposed by Ajzen (1985, 1991), *attitude toward behavior* refers to one's positive or negative response toward a particular behavior based on one's previous learning experience. In the present context, the attitudes of elementary school teachers toward web-based professional development are related to their past experiences with web-based professional development. The perceived lack of quality in web-based professional development curricula previously encountered by elementary school teachers (Borko, 2004) may have contributed to negative attitudes on their part toward web-based professional development. In the present study, *attitudes toward web-based professional development* are defined as the positive or negative responses of elementary school teachers toward web-based professional development based on their past experiences of participation in web-based professional development.

Many studies have used the Technology Acceptance Model as an important tool for measuring teachers' attitudes toward web-based professional development (Kao & Tsai, 2009; Scherer, Siddiq, & Teo, 2015; Schoonenboom, 2014). We adopted the web-based Professional Development Attitude Scale developed by Kao and Tsai (2009) and evaluated elementary school teachers' attitudes toward web-based professional development from four perspectives: usefulness, ease of use, emotion, and behavior. Lee, Cerreto, and Lee (2010) found that the explanatory power of attitudes with regard to behavioral intention was twice that of subjective norms and three times that of perceived behavioral control, indicating that attitudes exert a critical influence on behavioral intention, a finding broadly supported by Hung and Jeng (2013). These studies showed that, as is the case with subjective norms, attitudes are closely related to behavioral intention and are therefore worthy of further investigation.

Perceived Behavioral Control with respect to Web-based Professional Development

In the Theory of Planned Behavior, *control beliefs* are the various factors that hinder or support an individual's behaviors in a given context, including the resources and opportunities needed to execute the behavior, considerations of ease of acquisition, and so on. Variation in control beliefs leads to variation in perceived behavioral control. Therefore, when elementary school teachers must decide whether to engage in web-based professional development, considerations regarding the means for obtaining related resources and opportunities and the ease of engaging in web-based professional development are important factors that may influence their perceived behavioral control. We defined teachers' *perceived behavioral control* toward web-based professional development as the ease with which related resources can be controlled and web-based professional development can be implemented when considering the option of implementing web-based professional development in their teaching. Giannakos and Vlamos (2013) discovered that learners' perceived behavioral control affected their behavioral intentions to use education webcasts; however, Hung and Jeng (2013) found that perceived behavioral control had a limited and non-significant influence on the behavioral intentions of future educational technologists with respect to online learning. Thus, the relationship between perceived behavioral control and behavioral intention needs to be clarified. The present study will examine this factor to shed light on the influence of perceived behavioral control on the behavioral intentions of elementary school teachers regarding web-based professional development.

Gender and Age

The different backgrounds of elementary school teachers may affect their interests, intentions, engagement, and performance in web-based professional development. Therefore, in line with the recommendations of Terras and Ramsay (2012), we considered important demographic variables such as gender and age, with the aim of improving the comprehensiveness of our model. Zhou (2014) discovered a significant difference between genders with respect to web search behavior, with male students engaging in more web search behaviors than female students. Furthermore, Hung and Jeng (2013) discovered that age had a significant influence on future educational technologists' attitudes toward online learning and thereby on their behavioral intentions. Given these findings, our study will also investigate the effects of gender and age and interactions between them on the other variables.

METHODS

Research Framework: Proposed Model of Web-based Training Behavioral Intentions

The Theory of Planned Behavior can be used as a behavior-prediction model (Ajzen, 1985; Ajzen & Madden, 1986); in the present study, it is used to investigate the behavioral intentions of elementary school teachers regarding web-based professional development as reflected in behavioral outcomes and the effects of the normative expectations of important reference groups (such as superiors or peers), teachers' own attitudes and control beliefs regarding web-based professional development, and demographic variables such as gender and age. To achieve this goal, we propose our model of teachers' behavioral intentions regarding web-based professional development. As shown in [Figure 1](#), the model incorporates all of the aforementioned variables.

Target Sample

A purposive sampling method was employed to select 359 elementary school teachers from 30 public elementary schools in Northern and Southern Taiwan to participate in the study. To enhance the representativeness of our sample, the following selection criteria were established: (1) participants were required to possess at least 5 years of teaching experience; (2) participants were required to have participated in web-based professional development; and (3) participants were required to agree to abide by the norms of human research ethics and to be willing to provide detailed and truthful answers to the questionnaire.

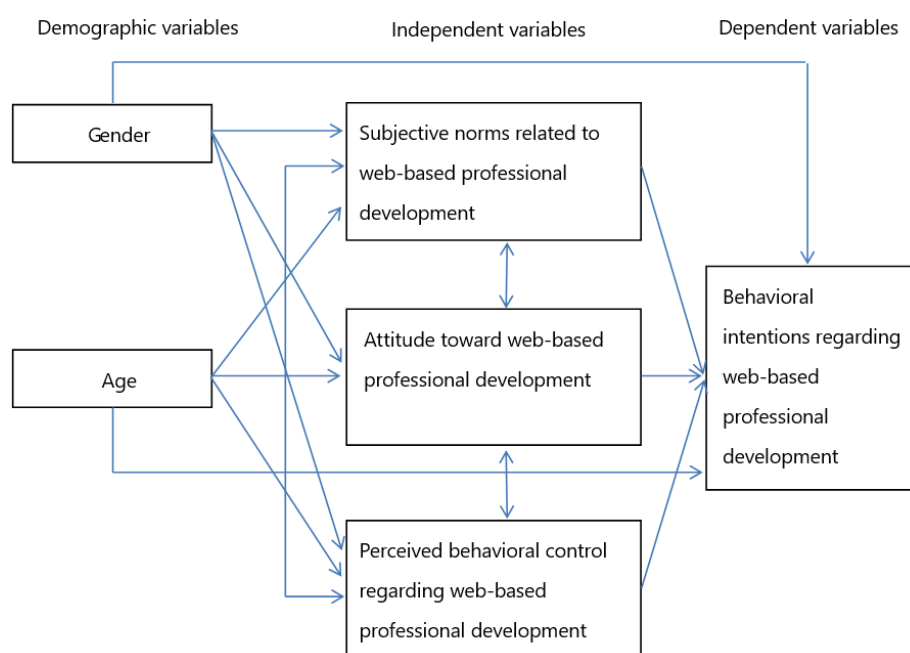


Figure 1. Proposed model of teachers' behavioral intentions regarding web-based professional development

Instrument

For the purpose of this study, we developed the Questionnaire of Elementary School Teachers' Behavioral Intentions Regarding Web-based Professional Development, which was composed of four research tools covering attitudes, subjective norms, perceived behavioral control, and behavioral intentions in relation to web-based professional development. To measure attitudes, we adopted the Web-based Professional Development Attitude Scale developed by Kao and Tsai (2009), which includes 15 questions covering (perceived) usefulness and ease of use, emotions, and behavior; a factor analysis explained 77.35% of the overall variance. To test subjective norms, eight questions were developed, targeting influence from superiors, peers, and members of two related professions; the results of a factor analysis explained 79.97% of the overall variance. To measure perceived behavioral control, we adopted the Web-based Professional Development Efficacy Scale developed by Kao, Tsai, and Shih (2014), which included 16 questions pertaining to the normal and interactive self-efficacy of elementary school teachers; the factor analysis explained 70.35% of the overall variance. Finally, we assessed behavioral intentions directly through seven questions; two professors in related disciplines were invited to conduct a content review of these questions, and they reached agreement with respect to their acceptability.

Data Analysis

Multiple regression path analysis was used to verify the goodness of fit of the structural model. The main analysis process consisted of the following four steps (Chiou, 2006): (1) calculation of the variance and covariance of variables; (2) calculation of the direct effects of exogenous variables on endogenous variables; (3) calculation of disturbance; and (4) effects analysis and explanations of the direct effects, indirect effects, and total effects in the path model. The main limitation of this method pertains to explanatory variables used to predict other variables; as this method is assumed to have no measurement error (or only a negligible one), only the residual error of explained or predicted variables can be estimated. Should subsequent studies seek to resolve this issue, we recommend replacing the data analysis method used in this study with path analysis based on Structural Equation Modeling so as to more comprehensively estimate the measurement errors of latent or observed variables.

RESULTS

Basic Descriptive Analysis of Variables

To explore elementary school teachers' behavioral intentions with respect to web-based professional development, we analyzed data pertaining to the two demographic variables and the four variables drawn from the Theory of Planned Behavior (outlined above). The results for demographic variables were as follows: (1) gender:

Table 1. Summary of the means, standard deviations, and correlation coefficients of questionnaire variables (n = 359)

	M	SD	A	SN	PBC	BI
Attitude (A)	3.48	0.34	1			
Subjective norms (SNs)	3.66	0.57	0.50*	1		
Perceived behavioral control (PBC)	4.23	0.52	0.41*	0.21*	1	
Behavioral intentions (BI)	4.06	0.49	0.66*	0.37*	0.55*	1

Note. * $p < .001$

Table 2. Summary of regression analysis

Model	R	R²	Adjusted R²	Std. error of the estimate	Durbin-Watson
1	.728	.530	.522	.339	2.001

Table 3. Summary of regression ANOVA

Model	Sum of squares	Degrees of freedom	Mean square	F
1 Regression	45.636	6	7.606	66.136*
Residual error	40.482	352	.115	
Total	86.118	358		

Note: * $p < .001$

Table 4. Summary of regression coefficients

Model	Unstandardized coefficients		Standardized coefficients	t	Confidence interval	
	B	SE	β		Lower Limit	Upper Limit
1 (Constant)	.117	.203		.579	-.281	.516
Gender	-.003	.041	-.002	-.066	-.084	.078
Age	.091	.058	.090	1.580	-.022	.204
Subjective norms	.043	.036	.051	1.202	-.028	.115
Attitude	.695	.066	.489	10.491*	.565	.826
Perceived behavioral control	.324	.040	.341	8.048*	.245	.403

Note: * $p < .001$

95 (26.5%) of the teachers were male and 264 (73.5%) were female; (2) age: 221 (61.5%) of the teachers were below 40 years of age, and 138 (38.5%) were 41 or above. The correlation coefficients, means, and standard deviations for the four variables based on the Theory of Planned Behavior are shown in **Table 1**. The correlation coefficients indicate significant correlations among the four variables; apart from the low correlation between subjective norms and perceived behavioral control, the remaining variables showed moderate or high correlations as defined by Cohen (1988). Among these, attitude and perceived behavioral control played particularly important roles in determining behavioral intentions regarding web-based professional development.

A Theoretical Model of Elementary School Teachers' Web-based Training Behavioral Intentions

Our model of elementary school teachers' behavioral intentions regarding web-based professional development is based on the Theory of Planned Behavior, with reference to related literature. Multiple regression path analysis was used to verify the model's goodness of fit based on the covariance relations among variables. Behavioral intention served as the dependent variable, and all variables were simultaneously included using the Enter method of multiple regression analysis, with the standardized regression coefficients used as the path coefficients. The analysis results in **Tables 2-4** indicate that the model effectively explained elementary school teachers' behavioral intentions regarding web-based professional development, with the two demographic variables and three Theory of Planned Behavior variables able to explain 53.0% of the variance with respect to behavioral intentions ($F(6, 352) = 66.136, p < .001$). However, further review of the results in **Table 4** shows that the main variables explaining behavioral intentions were attitude and perceived behavioral control. Therefore, these two variables were used as the dependent variables for regression analysis to complete the path diagram of elementary school teachers' behavioral intentions regarding web-based professional development.

With attitude as the dependent variable, variables such as gender, age, subjective norms, and perceived behavioral control were simultaneously included through the Enter method, and the standard regression coefficients were used as the path coefficients. The results presented in **Tables 5-7** indicate that these four variables were able to effectively explain 38.5% of the variance pertaining to the attitudes of elementary school teachers toward web-based professional development ($F(5, 353) = 44.258, p < .001$). Further review of the results in **Table 7** shows that all four variables fully explained these attitudes.

Table 5. Summary of regression analysis: Attitudes

Model	R	R ²	Adjusted R ²	Std. error of the estimate	Durbin-Watson
1	.621	.385	.377	.272	1.973

Table 6. Summary of regression ANOVA: Attitudes

Model	Sum of squares	Degrees of freedom	Mean square	F
1 Regression	16.413	5	3.283	44.258*
Residual error	26.183	353	.074	
Total	42.596	358		

Note: * $p < .001$

Table 7. Summary of regression coefficients: Attitude

Model	Unstandardized coefficients		Standardized coefficients	t	Confidence interval	
	B	SE	β		Lower Limit	Upper Limit
1 (Constant)	1.455	.143		10.156**	1.173	1.737
Gender	.071	.033	.091	2.145*	.006	.136
Age	.093	.046	.131	2.020*	.002	.184
Subjective norms	.251	.026	.417	9.730**	.200	.302
Perceived behavioral control	.243	.030	.363	8.183**	.184	.301

Note: * $p < .05$, ** $p < .001$

Table 8. Summary of regression analysis: Perceived behavioral control

Model	R	R ²	Adjusted R ²	Std. error of the estimate	Durbin-Watson
1	.506	.256	.246	.448	1.641

Table 9. Summary of regression ANOVA: Perceived behavior control

Model	Sum of squares	Degree of freedom	Mean square	F
1 Regression	24.476	5	4.895	24.346*
Residual error	70.976	353	.201	
Total	95.452	358		

Note: * $p < .001$

Table 10. Summary of regression coefficients: Perceived behavioral control

Model	Unstandardized coefficients		Standardized coefficients	t	Confidence interval	
	B	SE	β		Lower Limit	Upper Limit
1(Constant)	2.092	.244		8.575*	1.612	2.572
Gender	.017	.055	.014	.308	-.091	.124
Age	-.262	.075	-.247	-3.490*	-.409	-.114
Subjective norms	-.004	.048	-.005	-.085	-.098	.090
Attitude	.657	.080	.439	8.183*	.499	.815

Note: * $p < .001$

Next, perceived behavioral control was used as the dependent variable, with attitude adopted alongside the other explanatory variables using the method described above. The results in **Tables 8-10** show that these four variables were able to effectively explain 25.6% of the variance with respect to the perceived behavioral control of elementary school teachers regarding web-based professional development ($F(5, 353) = 24.346, p < .001$). However, further review of the results in **Table 10** showed that only two variables, namely age and attitude, fully explained the perceived behavioral control variable.

Based on the results of the three regression analyses above, path analysis was then used to complete the model of elementary school teachers' behavioral intentions regarding web-based professional development (**Figure 2**); the direct, indirect, and total effects related to this path analysis are shown in **Table 11**. Overall, the attitude of elementary school teachers toward web-based professional development was the most important explanatory variable influencing their behavioral intentions, followed by perceived behavioral control. In contrast, subjective norms proposed under the Theory of Planned Behavior did not affect these elementary school teachers' behavioral intentions with respect to web-based professional development (**Figure 2**). As for demographic variables, the results in **Table 11** show that neither gender nor age had a direct effect on behavioral intentions, although both did exert indirect effects. It is also worth noting that age had a negative effect on perceived behavioral control (-.247), indicating that as the respondents increased in age, their perceived behavioral control diminished.

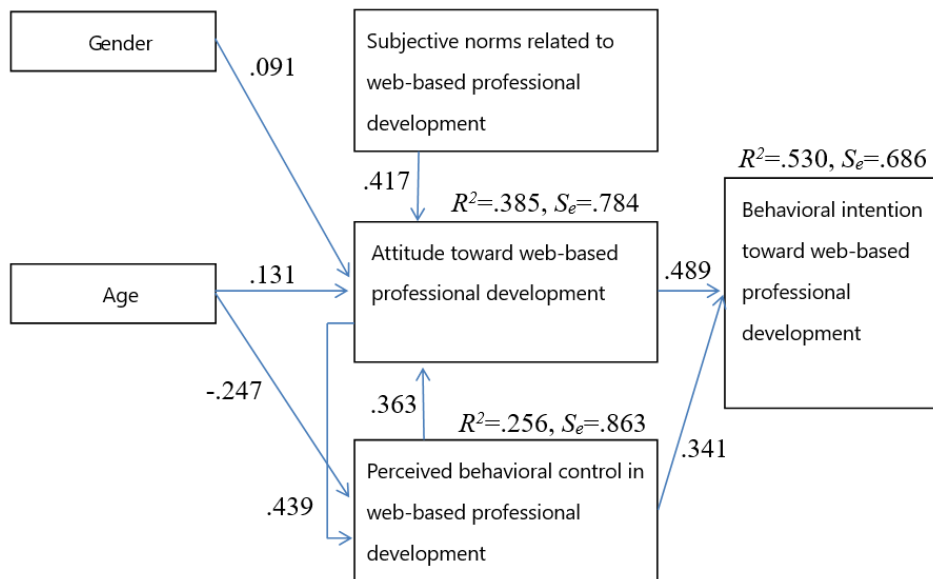


Figure 2. Path to elementary school teachers' behavioral intentions regarding web-based training

Table 11. Effects of path analysis in proposed model

Independent Variable		Dependent variable (endogenous variable)		
		Attitude	PBC	BI
Exogenous variable				
Gender	direct effect	.091	-	-
	indirect effect	-	.040	.044
	total effect	.091	.040	.044
Age	direct effect	.131	-.247	-
	indirect effect	-.090	.058	.335
	total effect	.041	-.189	.335
Endogenous variable				
Attitude	direct effect	-	.439	.489
	indirect effect	-	-	.150
	total effect	-	.439	.639
PBC	direct effect	.363	-	.341
	indirect effect	-	-	.178
	total effect	.363	-	.519
SN	direct effect	.417	-	-
	indirect effect	-	.183	.062
	total effect	.417	.183	.062

Note: PBC: Perceived behavioral control; BI: Behavioral intentions; SN: Subjective norms

DISCUSSION

The results of the above statistical analyses indicate that our model, which was constructed based on Ajzen's (1991) Theory of Planned Behavior, was able to effectively explain elementary school teachers' behavioral intentions with respect to web-based professional development. However, within the model, we found that the main explanatory power lay with two variables: attitude and perceived behavioral control. In contrast, the exogenous factor of subjective norms had no explanatory power. The latter result indicates that neither support nor opposition from important reference groups such as superiors or peers influenced elementary school teachers' behavioral intentions with respect to web-based professional development. Instead, the main factors influencing teachers' behavioral intentions were their personal or endogenous factors, including their attitudes and perceived behavioral control in relation to web-based professional development. The results of our study differed from the findings of Giannakos and Vlamos (2013) and those of Hung and Jeng (2013). This discrepancy may reflect the fact that these studies primarily considered the use of software or platforms; if the requirements for using these were standardized by education authorities, such external factors would have a direct impact on teachers. However, with respect to teachers' professional development, given that Taiwanese education authorities have standardized the number of

hours for professional development overall but have not specified requirements for web-based professional development, the influence of external pressures are weaker.

As noted, we found that attitude was the main variable explaining elementary school teachers' behavioral intentions regarding web-based professional development. This result is broadly consistent with the findings of Lee, Cerreto, and Lee (2010), which indicated that the explanatory power of attitude in relation to behavioral intentions was twice that of subjective norms and three times that of perceived behavioral control; however, our results show that attitude had 10.3 times the effect of subjective norms (.639/.062) but only 1.23 times that of perceived behavioral control (.639/.519). Regardless of these differences, it remains obvious that attitude constitutes a critical factor in explaining behavioral intention. Therefore, to foster positive behavioral intentions with respect to web-based professional development among (Taiwanese) elementary school teachers, emphasis should be placed on improving their attitudes – or alternatively, on strengthening their capacity (Ajzen, 1991) with respect to perceived behavioral control. In either case, relying solely on support from important reference groups such as superiors and peers should be avoided, as this factor was not shown to be influential.

In addition to the previously discussed variables drawn from the Theory of Planned Behavior, we also included the demographic variables of gender and age in our model, based on the recommendations of Terras and Ramsay (2012), with the aim of establishing a more comprehensive model of elementary teachers' behavioral intentions regarding web-based professional development. Indeed, our demonstration of the interactions of gender with and the other variables proved to be one of the main contributions of the present study. Gender had no direct effect on elementary school teachers' behavioral intentions; rather, gender exerted an indirect influence, mediated by attitude. However, the explanatory power of this variable was only .044, suggesting that elementary school teachers do not exhibit significant gender differences in behavioral intentions with respect to web-based professional development. Zhou (2014) revealed gender-based differences in web search behaviors; however, given that the scope of behaviors involved in web-based professional development is much broader than that in web search activity, we should not be surprised to find a weaker influence of gender.

As with gender, age had no direct impact on elementary school teachers' behavioral intentions regarding web-based professional development, but it did exert an indirect influence through variables such as attitude and perceived behavioral control. The conclusion that age influences behavioral intentions indirectly through attitude is consistent with the findings of Hung and Jeng (2013), who showed that age had an important impact on attitude and thereby an indirect influence on behavioral intentions. Moreover, we also found that age had a direct negative impact on perceived behavioral control (-.247), and thus negatively influenced behavioral intentions. This indicates that, when faced with the option of engaging in web-based professional development, older elementary school teachers possess weaker perceived behavioral control (e.g., a poorer ability to obtain related resources and opportunities), preventing them from engaging in web-based professional development with ease. Given that participants categorized as "senior teachers" in our study were above 40 years of age, they may be weaker with respect to computer-based and web skills; this would explain their weaker perceived behavioral control and its negative impact on behavioral intentions regarding web-based professional development.

CONCLUSION AND IMPLICATIONS

Based on the Theory of Planned Behavior and the recommendations of Terras and Ramsay (2012), this study sought to address two main research questions, and it reached the following conclusions: (1) the gender and age of elementary school teachers had no direct effect on their behavioral intentions regarding web-based professional development; however, age did have a negative impact on perceived behavioral control, and thus indirectly impaired behavioral intentions; and (2) attitude was the main factor influencing elementary school teachers' behavioral intentions regarding web-based professional development, followed by perceived behavioral control, whereas subjective norms did not influence behavioral intentions.

Based on the above conclusions, we offer the following suggestions for the improvement of elementary school teachers' behavioral intentions with respect to web-based professional development: (1) since the main variables affecting behavioral intentions were endogenous factors such as attitude and perceived behavioral control rather than exogenous factors such as subjective norms, emphasis should be placed on stimulating these former factors instead of using policies to compel elementary teachers to engage in web-based professional development; and (2) although age had a positive indirect influence on behavioral intentions mediated by attitude, this was outweighed by its negative impact with respect to perceived behavioral control; therefore, in order to help older elementary school teachers effectively engage in web-based professional development, more resources and opportunities are needed. For the future studies, the following suggestions could be taken into consideration in the near future: (1) The teachers' actual behavior regarding web-based professional development should be included according to the theory of planned behavior; (2) Further exploration of the sub components of teachers' attitude toward web-based professional development and perceived behavioral control in web-based professional development should be concerned for the clarifying the actual factors in predicting teachers' behavioral intentions regarding web-based

professional development; (3) Pynoo and Van Braak (2014) argued that the theory of planned behavior assumes a significant correlation between intention and behavior, but many studies fail to confirm this assumption; that is, the theory of planned behavior should be revised in order to predict the actual behavior through behavioral intention regarding web-based professional development.

ACKNOWLEDGEMENT

Funding of this research work is generously supported by grants from the National Science Council, Taiwan. The grant numbers are: MOST 105-2628-S-003-001-MY3 and MOST106-2511-S218-003.

REFERENCES

- Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckman (Eds.), *Action-control: From cognition to behavior* (pp. 11-39). Heidelberg: Springer. https://doi.org/10.1007/978-3-642-69746-3_2
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179-211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Ajzen, I. (2006). Constructing a theory of planned behavior questionnaire. Retrieved on March 27, 2015 from http://people.umass.edu/ajzen/pdf/tpb_measurement.pdf
- Ajzen, I., & Madden, T. J. (1986). Prediction of goal directed behavior: Attitudes, intentions, and perceived behavioral control. *Journal of Experimental Social Psychology*, 22, 453-474. [https://doi.org/10.1016/0022-1031\(86\)90045-4](https://doi.org/10.1016/0022-1031(86)90045-4)
- Bentler, P. M., & Bonett, D. G. (1980). Significance test and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, 88, 588-606. <https://doi.org/10.1037/0033-2909.88.3.588>
- Borko, H. (2004). Professional development and teacher learning: mapping the terrain. *Educational Researcher*, 33(8), 3-15. <https://doi.org/10.3102/0013189X033008003>
- Carlson, S., & Gadio, C. T. (2002). Teacher professional development in the use of technology. In J. Sikula (Ed.), *Handbook on teacher education*. New York: Macmillan.
- Cengiz, C. (2015). The development of TPACK, technology integrated self-efficacy and instructional technology outcome expectations of pre-service physical education teachers. *Asia-Pacific Journal of Teacher Education*, 43(5), 411-422. <https://doi.org/10.1080/1359866X.2014.932332>
- Chee, Y. S., Mehrotra, S., & Ong, J. C. (2015). Professional development for scaling pedagogical innovation in the context of game-based learning: teacher identity as cornerstone in "shifting" practice. *Asia-Pacific Journal of Teacher Education*, 43(5), 423-437. <https://doi.org/10.1080/1359866X.2014.962484>
- Chen, Y. H., Jang, S. J., Chen, P. J. (2015). Using wikis and collaborative learning for science teachers' professional development. *Journal of Computer Assisted Learning*, 31(4), 330-344. <https://doi.org/10.1111/jcal.12095>
- Chen, Y., Chen, N.-S., & Tsai, C.-C. (2009). The use of online synchronous discussion for web-based professional development for teachers. *Computers & Education*, 53(4), 1155-1166. <https://doi.org/10.1016/j.compedu.2009.05.026>
- Cheon, J., Lee, S., Crooks, S. M. & Song, J. (2012). An investigation of mobile learning readiness in higher education based on the theory of planned behaviour. *Computers & Education*, 59(3), 1054-1064. <https://doi.org/10.1016/j.compedu.2012.04.015>
- Chiou, H.-C. (2006). *Quantitative Research and Statistical Analysis in Social & Behavioral Sciences*. Taipei: Wunan.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Routledge Academic.
- Dede, C., Ketelhut, D. J., Whitehouse, P., Breit, L., & McCloskey, E. (2006). *A research agenda for online teacher professional development*. Cambridge, MA: Harvard Education Press.
- Giannakos, M. N., & Vlamos, P. (2013). Educational webcasts' acceptance: Empirical examination and the role of experience. *British Journal of Educational Technology*, 44(1), 125-143. <https://doi.org/10.1111/j.1467-8535.2011.01279.x>
- Hixon, E., & Buckenmeyer, J. (2009). Revisiting technology integration in schools: implications for professional development. *Computers in the Schools: Interdisciplinary Journal of Practice, Theory, and Applied Research*, 26(2), 130-146. <https://doi.org/10.1080/07380560902906070>
- Hung, W.-C., & Jeng, I. (2013). Factors influencing future educational technologists' intentions to participate in online teaching. *British Journal of Educational Technology*, 44(2), 255-272. <https://doi.org/10.1111/j.1467-8535.2012.01294.x>

- Kao, C.-P., & Tsai, C.-C. (2009). Teachers' attitudes toward web-based professional development, with relation to Internet self-efficacy and beliefs about web-based learning. *Computers & Education*, 53(1), 66-73. <https://doi.org/10.1016/j.compedu.2008.12.019>
- Kao, C.-P., Tsai, C.-C., & Shih, M. (2014). Development of a survey to measure self-efficacy and attitudes toward web-based professional development among elementary school teachers. *Educational Technology & Society*, 17(4), 302-315.
- Kao, C.-P., Wu, Y.-T., Tsai, C.-C. (2011). Elementary school teachers' motivation toward web-based professional development, and the relationship with internet self-efficacy and belief about web-based learning. *Teaching and Teacher Education*, 27(2), 406-415. <https://doi.org/10.1016/j.tate.2010.09.010>
- Lavonen, J., Lattu, M., Juuti, K., & Meisalo, V. (2006). Strategy-based development of teacher educators' ICT competence through a co-operative staff development project. *European Journal of Teacher Education*, 29(2), 241-265. <https://doi.org/10.1080/02619760600617433>
- Lee, J., Cerreto, F. A., & Lee, J. (2010). Theory of Planned Behavior and Teachers' Decisions Regarding Use of Educational Technology. *Educational Technology & Society*, 13(1), 152-164.
- Pynoo, B., Devolder, P., Tondeur, J., Van Braak, J., Duyck, W., & Duyck, P. (2011). Predicting secondary school teachers' acceptance and use of a digital learning environment: A cross-sectional study. *Computers in Human Behavior*, 27(1), 568-575. <https://doi.org/10.1016/j.chb.2010.10.005>
- Rasku-Puttonen, H., Eteläpelto, A., Lehtonen, O., Nummilla, L., & Häkkinen, P. (2004). Developing teachers' professional expertise through collaboration in an innovative ICT-based learning environment. *European Journal of Teacher Education*, 27(1), 47-60. <https://doi.org/10.1080/0261976042000211829>
- Scherer, R., Siddiq, F., & Teo, T. (2015). Becoming more specific: Measuring and modeling teachers' perceived usefulness of ICT in the context of teaching and learning. *Computers & Education*, 88, 202-214. <https://doi.org/10.1016/j.compedu.2015.05.005>
- Schoonenboom, J. (2014). Using an adapted, task-level technology acceptance model to explain why instructors in higher education intend to use some learning management system tools more than others. *Computers & Education*, 71, 247-256. <https://doi.org/10.1016/j.compedu.2013.09.016>
- Sugar, W., Crawley, F., & Fine, B. (2005). Critiquing theory of planned behaviour as a method to assess teachers' technology integration attitudes. *British Journal of Educational Technology*, 36(2), 331-334. <https://doi.org/10.1111/j.1467-8535.2005.00462.x>
- Sung, Y. T., Chang, K. E., Yu, W. C., & Chang, T. H. (2009). Supporting teachers' reflection and learning through structured digital teaching portfolios. *Journal of Computer Assisted Learning*, 25(4), 375-385. <https://doi.org/10.1111/j.1365-2729.2009.00312.x>
- Terras, M. M., & Ramsay, J. (2012). The five central psychological challenges facing effective mobile learning. *British Journal of Educational Technology*, 43(5), 820-832. <https://doi.org/10.1111/j.1467-8535.2012.01362.x>
- Treacy, B., Kleiman, G., & Peterson, K. (2002). Successful online professional development. *Learning and Leading with Technology*, 30(1), 42-47.
- Yuen, A. H.-K., & Ma, W. W.-K. (2008). Exploring teacher acceptance of e-learning technology. *Asia-Pacific Journal of Teacher Education*, 36(3), 229-243. <https://doi.org/10.1080/13598660802232779>
- Zhou, M. (2014). Gender difference in web search perceptions and behavior: Does it vary by task performance? *Computers & Education*, 78, 174-184. <https://doi.org/10.1016/j.compedu.2014.06.005>

<http://www.ejmste.com>