

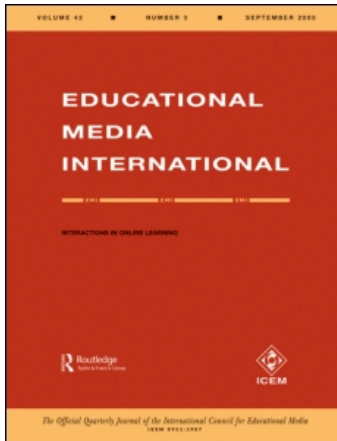
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Preservice teachers' acceptance of ICT integration in the classroom: applying the UTAUT model

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In this study, the researchers explore the factors that influence preservice teachers' acceptance of information and communication technology (ICT) integration in the classroom. The Unified Theory of Acceptance and Use of Technology (UTAUT) was developed by Venkatesh et al. [*MIS Quarterly*, 27(3), 425–478] in 2003 and shown to outperform eight preceding models, explaining 70% of the variance in user intentions. The role of the UTAUT variables (performance expectancy, effort expectancy, social influence, and facilitating conditions) are examined and the resulting regression model accounts for 27% of the variance in user intentions with effort expectancy surfacing as the only significant predictor of behavior intention. Results and recommendations for future research in the application of UTAUT are discussed.

Die Akzeptanz von IKT Integration im Unterricht von Lehramtsstudenten: Anwendung des UTAUT Modells

In dieser Studie erkunden die Forscher die Faktoren, die die Akzeptanz der Informations- und Kommunikationstechnik- (ICT) Integration in den Unterricht der auszubildenden Lehrer beeinflussen. Die vereinheitlichte Theorie von Annahme und Verwendung von Technik (UTAUT) wurde von Venkatesh et al. [*MIS Quarterly*, 27(3), 425–478] in 2003 entwickelt und hat acht vorhergehende Modelle übertroffen und dabei 70% des Unterschieds durch Benutzerabsichten erklärt. Die Rolle der UTAUT-Variablen (Leistungserwartung, Bemüherwartung, sozialen Einfluss und dem Erleichtern von Bedingungen) sind geprüft und entstehende "Zurückentwicklungs" Modellkonten zu 27% des Unterschieds in Benutzerabsichten bei der Bemüherwartung erklärt, als die Einzige bedeutsame Vorhersage. Ergebnisse und Empfehlungen für zukünftige Forschung in der Bewerbung von UTAUT werden erörtert.

L'acceptation chez les élèves-professeurs de l'intégration des TICE dans la classe: une application du modèle TUAUT

Dans la présente étude, les chercheurs examinent les facteurs qui influencent l'acceptation de l'intégration des TICE de la part des enseignants en formation initiale. La Théorie Unifiée de l'Acceptation et de l'Usage de la Technologie (TUAUT) a été mise au point par Venkatesh et al. [*MIS Quarterly*, 27(3), 425–478] en 2003 et s'est révélée plus performante que huit autres modèles précédents, pouvant expliquer 70% de la variance dans les intentions des utilisateurs. Le rôle des variables TUAUT (performances attendues, effort attendu, influence sociale et conditions facilitantes) est examiné et le modèle régressif explique 27% de la

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variance dans les intentions des utilisateurs, l'expectative d'effort apparaissant comme le seul indicateur significatif des intentions de comportement. On examine les résultats et les recommandations pour les recherches futures sur l'application de TUAUT.

La aceptación de la integración de las TICs en aulas por parte de los profesores en formación inicial: una aplicación del modelo TUAUT

En el presente estudio, los investigadores examinan los factores que influyen sobre la aceptación de las TICs por parte de los docentes en formación inicial. La Teoría Unificada de la Aceptación y del uso de la Tecnología (TUAUT) fue desarrollada por Venkatesh et al. [*MIS Quarterly*, 27(3), 425–478] in 2003 y salió con mejores resultados que ocho modelos anteriores, siendo capaz de explicar el 70% de las variaciones en las intenciones de los usuarios. Se examina el papel de las variables TUAUT (expectaciones de rendimiento, expectativas de esfuerzo, la influencia social, y la condiciones facilitantes) y el modelo regresivo explica el 27% de las variaciones en las intenciones de los usuarios, la expectativa de esfuerzo apareciendo como el único indicador significativo de las intenciones de comportamiento. Los autores discuten también los resultados y las recomendaciones para futuras investigaciones sobre la aplicación de TUAUT.

Keywords: ICT integration; preservice teachers; technology acceptance

Introduction

Information and communication technology (ICT) is becoming increasingly important in Canadian education. For example, the British Columbia (BC) Ministry of Education outlines the integration of ICT throughout the Kindergarten to Grade 12 curriculum (British Columbia Ministry of Education, 2005a) and such initiatives are prevalent elsewhere across the country (e.g. Alberta Learning, 2003; Ontario Ministry of Education, 1998). The integration of ICT into education is also encouraged by the British Columbia Premier's Technology Council: "in order for the education system to stay relevant and to engage our students more fully, it must make better use of technology in classrooms across this province" (2007). Technology use is constantly evolving and becoming more important in the workplace and our lives (Karsenti, Brodeur, Deaudelin, Larose, & Tardif, 2002; Shapka & Ferrari, 2003). ICT in education is also a motivator for students (as represented by Burns & Ungerleider, 2003, in a systematic review of the literature on ICT in elementary and secondary education) as it relates to their interests and their lives.

According to a Statistics Canada survey (2004), Canadian schools have the necessary infrastructure for implementing ICT into classroom learning. Findings indicate that 99% of schools in Canada have computers, with a student to computer ratio of five to one in BC (Statistics Canada). Over 97% of schools in Canada have Internet access. The survey indicates that there is support from administration for technology: 92% of principals in Canada believe that ICT is worth the money and the benefits are important to students (Statistics Canada). Possible response bias must be considered when interpreting these results as ICT-poor schools or schools with leaders who do not value ICT may not have been motivated to participate in an ICT-based survey, while those that have already invested heavily in ICT could view this survey as an opportunity to showcase their efforts. Looker and Thiessen (2003) report differences in ICT access and use with respect to gender, social economic status, and rural/urban settings. Statistics Canada also recognizes the possible error resulting from non-responses and therefore used a "weighting methodology based on

key auxiliary information” (Statistics Canada, p. 32) to assign weights “to each school [that] represent the number of other schools in the population with similar characteristics” (p. 32).

Regardless of the level of available infrastructure and support from administration, there is concern as to whether teachers are prepared to integrate the technology that is available to them into effective lessons for their students (BC Premier’s Technology Council, 2007; Brown & Warschauer, 2006; Firek, 2002). According to Statistics Canada, 76% of schools in Canada have more than 75% of their teachers “with the required technical skills to use ICT for administrative purposes” (2004, p. 25). Yet only 46% of Canadian schools have more than 75% of their teachers “with the necessary qualifications to engage students in using ICT effectively” (Statistics Canada, p. 25). Therefore, if we value the integration of ICT in education, then it is important that we ensure that our new, upcoming teachers are comfortable and capable to integrate ICT into our student’s educations. This study aims to help determine how best to make this possible.

Objectives/purpose

The purpose of this study is to examine the factors that influence preservice teachers’ acceptance of information and communication technology (ICT) integration in the classroom. The study examines the effects of Venkatesh, Morris, Davis and Davis’s (2003) Unified Theory of Acceptance and Use of Technology (UTAUT) variables on preservice teachers’ acceptance.

The following research questions will be addressed:

- (1) Do the UTAUT variables (performance expectancy, effort expectancy, social influence, facilitating conditions) influence preservice teachers’ acceptance of ICT integration?
- (2) Do gender, age, and voluntariness moderate the effect of the four direct determinants in the UTAUT model (performance expectancy, effort expectancy, social influence, and facilitating conditions)?

The overall goal of this research was to learn how to help our preservice teachers feel comfortable integrating ICT in order to prepare them for an educational system that values technology. These teachers will then be able to help prepare our K-12 students to use technology to improve their work opportunities and enhance their day-to-day life. The study also identified what faculty and administrators can do to improve their teacher education programs to prepare preservice teachers for ICT integration in the classroom.

Theoretical framework

Many models of technology acceptance have been developed over the years, some of which have been used to examine preservice teachers’ acceptance of technology. In 2003, Venkatesh et al. created the Unified Theory of Acceptance and Use of Technology (UTAUT). Venkatesh et al. integrated elements from eight IT acceptance models to create their model. Gender, age, experience, and voluntariness of use were added to the model and were hypothesized to moderate the effect of four constructs

(performance expectancy, effort expectancy, social influence, and facilitating conditions) on intention to use and usage behavior. Behavioral intention is seen as a critical predictor of technology use (Venkatesh et al., 2003). Self-efficacy and anxiety were determined by Venkatesh et al. to be indirect determinants, and therefore unnecessary in the model. The UTAUT survey was tested by Venkatesh et al. and found to have an R^2 of 70%, indicating that the model explains 70% of the variance in user intentions to use information technology. The UTAUT model has not yet been used to examine preservice teachers' acceptance of ICT. Only three studies have been located that utilize the UTAUT model in an educational setting. The aim of the current study is to test the use of the UTAUT model with preservice teachers in order to help identify one model that can be used consistently in future research in an educational context.

Methods

Approach

The study used an embedded triangulation mixed-methods approach. A mixed-methods approach was selected because "the combination of quantitative and qualitative approaches provides a better understanding of research problems than either approach alone" (Creswell & Plano Clark, 2007, p. 8). An *embedded triangulation* mixed-methods design was chosen because the study focused on bringing together the "differing strengths and non-overlapping weaknesses of quantitative methods (large sample size, trends, generalization) with those of qualitative methods (small N , details, in depth)" (Creswell & Plano-Clark, 2007, p. 62).

This study uses the qualitative data to illuminate answers given by participants on the survey and determine whether any issues outside of the UTAUT factors influence preservice teachers' acceptance of ICI integration. Quantitative data in this study was obtained using the survey of UTAUT items and additional information on age, gender, voluntariness, education program, and teaching area. This study only utilized a one-time survey, therefore experience could not be included because Venkatesh coded experience "based on point of measurement and does not reflect 'actual experience' or knowledge. It simply notes the ordinal nature of early experience (post training) to several months after implementation" (V. Venkatesh, personal communication, September 20, 2008). Following the administration of the quantitative survey, the qualitative data was obtained through focus groups conducted with a subsample of the participants. This paper will report the findings from the quantitative phase of the study, and the qualitative results will be written up with the results obtained from the follow-up focus groups, to be held at the end of the preservice teachers' practicum experience.

Recruitment and sampling

The population of interest in this study consisted of secondary level preservice teachers in all teaching areas. All preservice teachers who were enrolled in secondary education teaching programs (post degree professional program or bachelor of education) at this mid-sized western Canadian university were asked for their participation in the study in November of 2008. For the quantitative phase, convenience sampling was used to select a sample to represent the population, as participants were selected from the researchers' home university.

Instruments

Each participant was asked to complete the UTAUT survey (see Appendix 1), consisting of four items that explore each of the direct determinants, four items for voluntariness of use, one for each of gender and age, and three that explore behavioral intention. The UTAUT survey items use a seven-point Likert scale, ranging from a rating of 1 indicating strongly disagree, to a rating of 7 indicating strongly agree, with 4 being neutral. All participants were given the opportunity to indicate on their survey whether they would be interested in participating in a follow-up focus group, which occurred in December 2008.

Participant profile

Every year this mid-sized western Canadian university admits approximately 120–140 secondary education students into the post degree professional program (PDPP) and 40–50 students into the secondary bachelor of education (BEd) program. Eighty-five UTAUT surveys were obtained, which gave a participation rate of 53%. The participants of the survey ranged in age from 21 to 42 years, with a mean age of 25.49, and standard deviation of 3.51 (Table 1). The majority, 89% of the participants, were under the age of 30.

Fifty (61%) of the preservice teachers that took part in the survey were female, with 32 (39%) being male.

Thirty-five of the 82 participants (42.7%) indicated a single teaching area; all others identified two or more high school subject areas in which they specialized. The subject indicated by the most preservice teachers was social studies, with physics/chemistry/biology/science as the second most common. Mathematics and physical education were the two least common teaching areas amongst this group of secondary preservice teachers.

Results

Performance of UTAUT measure

Item reliability

Cronbach's alpha was calculated to determine the reliability of the items for each of the UTAUT constructs. A minimum Cronbach's of .70 is typically used, although Leech, Barrett and Morgan (2004) indicate that it is "common to see journal articles where one or more scales have somewhat lower alphas (e.g. in the .60–.69 range), especially if there is only a handful of items in the scale" (p. 14). Performance expectancy and effort expectancy both had acceptable Cronbach's alphas (.69 and .86 respectively) with the inclusion of all four items for each construct. Behavioral

Table 1. Age of the preservice teachers.

Age	No. of individuals	Percentage of sample
20–24 years	41	50.0
25–29 years	32	39.1
30–34 years	7	8.5
35–42 years	2	2.4
Total	82	100

intention (three items) and voluntariness of use (four items) had Cronbach's alphas of .87 and .70, indicating that the items for these two constructs are reliable. The Cronbach's alpha for social influence was .52, indicating a reliability issue with the items. Removal of item 9 ("Senior K-12 officials would be helpful in the use of technology for teaching in the K-12 classroom") raised the alpha slightly, but only to .57. Omission of both items 9 and also 5 ("In general, senior K-12 officials would support the use of technology in the K-12 classroom") gave a Cronbach's of .63, indicating that the two remaining items worked together to provide a reliable measure of the social influence construct. The Cronbach's alpha for facilitating conditions was .60 when all four items were included. When item 16 ("Using technology for teaching in the K-12 classroom would not be compatible with other teaching responsibilities that I have") was deleted, the alpha was increased to .72. When the correlations between this item and the other three items for facilitating conditions were run, it was seen that item 16 is not correlated with the other three items.

Construct creation

With item reliability established, the means were used to combine the items for each construct. Performance expectancy, effort expectancy, voluntariness of use, and behavioral intention retained all of their items from the survey. For facilitating conditions, item 16 was omitted, and both items 5 and 9 were dropped from the social influence construct. The kurtosis and skewness of each variable was then analyzed in order to check for normality. The skewness and kurtosis was within range (between -1 and +1 for skewness and a value close to zero for kurtosis) for all six of the constructs.

The four main constructs

Venkatesh et al. hypothesized that performance expectancy, effort expectancy, and social influence all have a significant direct effect on behavioral intention. They hypothesized that facilitating conditions would not have a significant effect on intention, but would affect usage behavior (in later time trials). In the following sections, the survey responses are examined for each of the four direct determinants, as well as voluntariness of use, and behavioral intention. The correlations are discussed for each construct with behavioral intention (Table 2).

Table 2. Correlations between independent and dependent variables.

Subscale	1	2	3	4	5
Preservice teachers teachers ($n=82$)					
1. EE	–	.366**	.680**	.155	.520**
2. PE		–	.197	.391**	.387**
3. FC			–	.142	.371**
4. SI				–	.256*
5. BI					–

Note: *Correlation is significant at the 0.05 level (two-tailed). **Correlation is significant at the 0.01 level (two-tailed). EE, effort expectancy; PE, performance expectancy; FC, facilitating conditions; SI, social influence; BI, behavioral intention. The struck out items were removed from the analysis.

Performance expectancy

The construct of performance expectancy is defined as “the degree to which an individual believes that using the system will help him or her to attain gains in job performance” (Venkatesh et al., 2003, p. 447). In this study, performance expectancy had a mean response of 5.57, and standard deviation of .70. The construct was significantly correlated with behavioral intention at the .01 level (two-tailed), with a correlation coefficient of .39. Item number 18, “I would find using technology for teaching in the K-12 classroom useful” had the highest correlation with behavioral intention (.61), which was much higher than the other three items; 76.9% of the participants responded “agree” or “strongly agree” to this statement (see Table 3 for a complete breakdown of the frequencies of responses to each item in this construct). It is interesting to note that just over half of the participants (51.2%) indicated that they believe that using technology for teaching in the K-12 classroom will enable them to increase their employment opportunities.

Effort expectancy

Effort expectancy is defined as “the degree of ease associated with the use of the system” (Venkatesh et al., p. 450). The construct of effort expectancy had a mean response of 5.1565, and a standard deviation of 1.05. Effort expectancy was significantly correlated with intention, with a coefficient of .52 (this was the highest correlation with intention of the four main constructs). All four of the items within this construct were significantly correlated with behavioral intention, but the strongest correlation was with item 13 (“Learning to use technology for teaching in the K-12 classroom would be easy for me”). This item had a correlation of .53 with intention.

Table 4 displays the frequency of responses for each of the four items within effort expectancy. For all four items, less than half of the participants responded “agree” or “strongly agree” to the statements – 48.8%, 37.8%, 37.8%, and 46.3% respectively for items 1, 8, 6, and 13. These results indicate that the majority of the participants are not extremely confident in the ease of use associated with ICT in the K-12 classroom.

Social influence

Social influence is defined as “the degree to which an individual perceives that important others believe he or she should use the new system” (Venkatesh et al., p. 451). Social influence had a mean of 5.13 and standard deviation of .87. This construct was significantly correlated with intention, with a coefficient of .26. Table 5 gives a breakdown of the responses for this construct.

Item 5 (“In general, senior K-12 officials would support the use of technology in the K-12 classroom”) had an overwhelmingly positive response from the participants compared to the other three items, with 78.1% of the participants responding with “agree” or “strongly agree”. Compare this with item 9, where only 18.3% of participants responded “agree” or “strongly agree”, indicating that the preservice teachers feel that senior K-12 officials would support the use of ICT, but would not be helpful in implementation. These two items (5 and 9) were dropped from the construct, as they did not work with the other items to provide a reliable measure.

Table 3. Performance expectancy frequency distributions.

Performance expectancy	1	SD	2	3	4	5	5.5	6	7	SA
#18: I would find using technology for teaching in the K-12 classroom useful	#	0	0	0	1	17	1	39	24	
	%	0	0	0	1.2	20.7	1.2	47.6	29.3	
#2: Using technology for teaching in the K-12 classroom would enable me to accomplish tasks more quickly	#	0	0	1	10	33	0	25	13	
	%	0	0	1.2	12.2	40.2	0	30.5	15.9	
#10: Using technology for teaching in the K-12 classroom would increase my productivity”	#	0	2	4	12	30	0	25	9	
	%	0	2.4	4.9	14.6	36.6	0	30.5	11	
#12: If I use technology for teaching in the K-12 classroom, I will increase my employment opportunities	#	0	0	0	15	25	0	23	19	
	%	0	0	0	18.3	30.5	0	28	23.2	

Note: SD, strongly disagree; SA, strongly agree.

Table 4. Effort expectancy frequency distributions.

Effort expectancy	1	SD	2	3	4	5	6	7	SA
#1: My interaction with technology for teaching in the K-12 classroom would be clear and understandable	#	0	3	2	18	18	29	11	
	%	0	3.7	2.4	22	22	35.4	13.4	
#8: It would be easy for me to become skillful at using technology for teaching in the K-12 classroom	#	0	2	8	9	32	19	12	
	%	0	2.4	9.8	11	39	23.2	14.6	
#6: I would find using technology for teaching in the K-12 classroom easy to do	#	1	1	10	15	24	20	11	
	%	1.2	1.2	12.2	18.3	29.3	24.4	13.4	
#13: Learning to use technology for teaching in the K-12 classroom would be easy for me	#	0	2	7	9	26	28	10	
	%	0	2.4	8.5	11	31.7	34.1	12.2	

Note: SD, strongly disagree; SA, strongly agree.

Table 5. Social influence frequency distribution.

Social influence	1	2	3	4	5	6	7	SA
#19: People who influence my behavior would think that I should use technology for teaching in the K-12 classroom	#	0	1	17	32	22	8	
	%	0	1.2	20.7	39	26.8	9.8	
#14: People who are important to me would think that I should use technology for teaching in the K-12 classroom	#	0	2	24	24	26	5	
	%	0	1.2	29.3	29.3	31.7	6.1	
#9: Senior K-12 officials would be helpful in the use of technology for teaching in the K-12 classroom	#	0	0	11	26	14	1	
	%	0	0	13.4	34.1	17.0	1.2	
#5: In general, senior K-12 officials would support the use of technology in the K-12 classroom	#	0	0	0	14	51	13	
	%	0	0	0	2.4	17.1	15.9	

Note: SD, strongly disagree; SA, strongly agree.

The two remaining items, numbers 19 and 14, had a much smaller percentage of positive responses: 36.6% and 37.8% of the individuals indicated that they “agree” or “strongly agree” with these statements. It appears that the preservice teachers do not believe that the people who influence them or are important to them would think that they should use ICT in their teaching. From the surveys, it is unclear who the participants are imagining when answering these items – their friends, family, colleagues, high school students, etc.

Facilitating conditions

Facilitating conditions is defined as “the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system” (Venkatesh et al., p. 453). This construct had a mean of 4.80 and standard deviation of 1.12. Facilitating conditions was significantly correlated with behavioral intention, with a coefficient of .37. In order to align the four items for this construct, item number 16 was reversed during the analysis, so that a response of one became a seven, a two became a six, and so on. Item 17 stands out as the item with the fewest preservice teachers responding with “agree” or “strongly agree”. Only 22% of the participants indicated that they believe there is a specific person/group that would be available to help them with difficulties they may encounter with the use of ICT. The responses to the other items were also relatively low – 35.4% responded “agree” or “strongly agree” to item 23, 46.4% to item 20, and 56.1% to item 16. These responses indicate that many preservice teachers do not feel that they have the knowledge, resources, and help that they require to use ICT successfully in their teaching practicum. Table 6 gives the frequencies of responses for the four items within the construct of facilitating conditions.

Voluntariness of use

Voluntariness of use was measured using four items within the UTAUT survey. The frequency table below (Table 7) shows the mixed responses for this construct. At the extreme, only 7.3% of participants indicated “agree” or “strongly agree” to item 15 – “My superiors would not expect me to use technology for teaching in the K-12 classroom”. The mean response for this item was 3.7, indicating that most participants somewhat disagree, and feel that their superiors would expect them to use ICT. When asked directly whether the use of ICT would be voluntary in their K-12 teaching (item 22), 47.6% of the individuals responded “agree” or “strongly agree”, and the mean response was 5.2. Not a single participant indicated that they “disagree”, or “strongly disagree” with this statement, and only 9.8% indicated “somewhat disagree”. This indicates that a very small proportion of the participants believe that the use of ICT in their teaching is mandatory, and the majority of participants “somewhat agree” with the statement that ICT use would be voluntary.

Behavioral intention

The three UTAUT items for behavioral intention were used by Venkatesh et al. to ask participants about their intended use of ‘the system’ in the next $<n>$ months. In this study, the items were reworded to ask the preservice teachers about their intention to use ICT during their upcoming three-month teaching practicum (which began January 5, 2009).

Table 6. Facilitating conditions frequency distribution.

Facilitating conditions	1	SD	1.5	2	3	4	5	6	7	SA
#23: I have the resources necessary to use technology for teaching in the K-12 classroom	#	2	0	5	5	18	22	19	10	
	%	2.4	0	6.1	6.1	22	26.8	23.2	12.2	
#20: I have the knowledge necessary to use technology for teaching in the K-12 classroom	#	0	0	5	9	7	23	25	13	
	%	0	0	6.1	11	8.5	28	30.5	15.9	
#16: Using technology for teaching in the K-12 classroom would not be compatible with other teaching responsibilities that I have	#	2	1	2	3	9	19	35	11	
	%	2.4	1.2	2.4	3.7	11	23.2	42.7	13.4	
#17: A specific person (or group) would be available for assistance with difficulties when using technology for teaching in the K-12 classroom	#	1	0	5	15	19	21	15	3	
	%	1.2	0	6.1	18.3	23.2	25.6	18.3	3.7	

Note: SD, strongly disagree; SA, strongly agree.

Table 7. Voluntariness of use frequency distribution.

Voluntariness of use	1	SD	2	3	4	5	6	7	SA
#4: Although it might be helpful, using technology for teaching in the K-12 classroom would certainly not be compulsory in my job	#	1	8	14	20	19	15	5	
	%	1.2	9.8	17.1	24.4	23.2	18.3	6.1	
#11: My boss (principal) would not require me to use technology for teaching in the K-12 classroom	#	2	5	13	21	14	21	5	
	%	2.4	6.1	15.9	25.6	17.1	25.6		
#15: My superiors would not expect me to use technology for teaching in the K-12 classroom	#	5	7	24	17	22	4	2	
	%	6.1	8.5	29.3	20.7	26.8	4.9	2.4	
#22: Using technology for teaching in the K-12 classroom would be voluntary (as opposed to required by superiors/job	#	0	0	8	16	19	29	10	
	%	0	0	9.8	19.5	23.2	35.4	12.2	

Note: SD, strongly disagree; SA, strongly agree.

The majority of the participants indicated an intention to use ICT in their teaching practicum. A large number of individuals responded “agree” or “strongly agree” for each of the three items: item 21 (I intend) – 65.9%, item 3 (I am determined) – 70.7%, and item 7 (I plan) – 78%. Table 8 gives the frequency distributions for these items.

The regression

Multiple regression was used to determine whether the UTAUT constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) are significant predictors of secondary preservice teachers’ intention to use ICT in their teaching practicum. In the initial analysis, a standard multiple regression was performed with all four UTAUT constructs input as independent variables, and behavioral intention as the dependent variable. SPSS Regression was used for the analysis. The F -test was significant, meaning that the hypothesis of $R^2=0$ can be rejected. An R^2 of .33 was obtained, and only effort expectancy was shown to be a significant predictor of behavioral intention. With this knowledge, the regression was carried out a second time, with effort expectancy as the independent variable, and intention as the dependent variable. In this follow up, the F -test was significant, and an R^2 of .27 was obtained, indicating that 27% of the variance in intention is accounted for by the model. This is not a significant decrease from the R^2 initially obtained with all four predictor variables included in the model.

The standardized regression equation obtained through this analysis was behavioral intention = $3.80 + .52$ (effort expectancy). This beta weight has error in the way it is estimated, but we can say with 95% confidence that the beta is within the range of 0.26 to 0.57. These results indicate that effort expectancy is the only significant predictor of intention, and as effort expectancy increases by one standard deviation, behavioral intention increases by .52 standard deviations. According to the model, performance expectancy, social influence, and facilitating conditions are not significant predictors of preservice teachers’ intention to use ICT. Venkatesh et al. (2003) hypothesized that facilitating conditions would not have an influence on intention (but would later have an effect on usage), and this hypothesis was proven correct in this study. Table 9 gives the results from this second multiple regression.

Effects of the moderators

Venkatesh et al. (2003) hypothesized that gender, age, experience, and voluntariness of use would moderate the effect of the four direct determinants on intention and usage. In order to test the effects of the moderators, a three-block multiple regression was performed. The first block consisted of the mean-centered variables effort expectancy, performance expectancy, social influence, and facilitating conditions. The second block contained the mean-centered moderators, gender, age, and voluntariness of use. In this study, the participants’ experience level is 0 (as measured by Venkatesh et al.) and this variable is therefore not included as a moderator in this T1 administration of the survey. The third and final block of the regression contained the 12 interaction terms – this block was performed step-wise so that each interaction term was only entered into the equation if it was statistically significant. This was done in an attempt to minimize the effects of multicollinearity.

Table 8. Behavioral intention frequency distribution.

Behavioral intention	1	SD	2	3	4	5	6	7	SA
#21: I intend to use technology for teaching in the K-12 classroom during my 3-month teaching practicum	#	0	0	1	6	21	36	18	
	%	0	0	1.2	7.3	25.6	43.9	22	
#3: I am determined that I will use technology for teaching in the K-12 classroom during my 3-month teaching practicum	#	0	1	0	6	17	32	26	
	%	0	1.2	0	7.3	20.7	39	31.7	
#7: I plan to use technology for teaching in the K-12 classroom during my 3-month teaching practicum	#	0	0	0	5	13	36	28	
	%	0	0	0	6.1	15.9	43.9	34.1	

Note: SD, strongly disagree; SA, strongly agree.

Table 9. Multiple regression.

	Unstandardized coefficients		Standardized coefficients	<i>t</i>	Sig.
	<i>B</i>	<i>SE</i>	Beta		
(Constant)	3.797	.398		9.538	.000
EE	.412	.076	.520	5.439	.000

Note: EE, effort expectancy.

The *F*-tests indicated that the main effect (Model 1) and the interaction effect (Model 2) were both significant. None of the interaction effects was significant, and therefore they were never entered into the equation during the regression. In Model 1, the mean-centered variable for effort expectancy was shown to be the only independent correlate. In Model 2, only one main effect emerged. Age was shown to be an independent main effect, with a beta coefficient of $-.26$. This indicates that as age increases, behavioral intention decreases. Age was the only significant effect – gender and voluntariness of use were insignificant. Table 10 gives the results for this three-block regression analysis. Thus, the only hypothesis that was proven true in this study was the effect of age as a moderator on behavioral intention.

Discussion

The UTAUT model

The UTAUT model was developed by Venkatesh et al. in 2003. Since then the model has been used to examine the acceptance of specific technologies within the business environment, but seldom used within education. Only three studies were located that used the UTAUT model in education: one examined faculty acceptance of tablet PCs, one looked at the use of MSN/webboard, and the third study examined students'

Table 10. Moderator effects.

Model	Unstandardized coefficients		Standardized coefficients	<i>t</i>	Sig.
	<i>B</i>	<i>SE</i>	Beta		
1					
(Constant)	5.919	.077		76.541	.000
MCEE	.320	.107	.405	3.001	.004
MCPE	.219	.128	.185	1.709	.092
MCSI	.110	.097	.115	1.126	.264
MCFC	.032	.095	.043	.337	.737
2					
(Constant)	5.919	.074		80.320	.000
MCAge	-.061	.023	-.256	-2.644	.010
MCGender	-.242	.159	-.143	-1.523	.132
MCVol	-.101	.077	-.119	-1.300	.198

Note: EE, effort expectancy; PE, performance expectancy; SI, social influence FC, facilitating conditions.

acceptance of all administrative and instructional technology used in an undergraduate marketing class.

The current study found that the UTAUT model explained 27% of the variance in preservice teachers' intention to use ICT in their teaching. The only significant predictor was effort expectancy, and the only significant moderator was age. These results are supported by the literature: Smarkola (2007) found that perceived ease of use and perceived usefulness together accounted for 48% of the variance in user's intentions to use ICT. In contrast, Smarkola discovered that perceived usefulness was most influential of the two factors. Similarly, Yuen and Ma (2002) found perceived usefulness to be the significant predictor of intention and usage (with perceived ease of use having an effect on perceived usefulness, but not directly on intention). Ma, Andersson and Streith (2005) also found perceived usefulness and perceived ease of use to be the significant predictors of behavioral intention.

Some previous studies have discovered various other constructs to be the most influential factor in predicting preservice teachers' intention to use ICT. Kadujevich, Happasalo and Hvorecky (2005) found that preservice teachers' interest in attaining ISTE standards is influenced by computer attitude; Kadujevich then later discovered that professional support has an influence on attitude (2005). Anderson and Maninger (2007) discovered that self-efficacy, value beliefs, and gender account for 32% of the variance in user intentions, with self-efficacy having the greatest effect. In order to allow for comparisons between studies, it is important to discover a consistent model that can be used throughout education and the study of preservice teachers' intentions to use ICT. This study suggests that the UTAUT model should be considered.

Performance expectancy

Performance expectancy was significantly correlated with behavioral intention, with a value of .39. The mean response from the UTAUT surveys was 5.57. Item 18 ("I would find using technology for teaching in the K-12 classroom useful") had the highest correlation with intention; 76.9% of the participants answered "agree" or "strongly agree" to this statement. Venkatesh et al. hypothesized that performance expectancy would have a significant effect on intention, and that the construct would be moderated by gender and age. These hypotheses were not supported by the current study, yet it was discovered that the participants believed that using ICT would be helpful to them in their teaching.

Effort expectancy

Effort expectancy had the highest correlation with behavioral intention (.52) and was the only construct proven to be a significant predictor of behavioral intention. Venkatesh et al. hypothesized that effort expectancy would have a significant influence on behavioral intention, with gender and age as moderators. This study proved that the moderators were not significant in this case. For all four effort expectancy items, less than half of the participants responded "agree" or "strongly agree", indicating that the majority of the individuals were not confident in the ease of use associated with the use of ICT in the K-12 classroom.

Since effort expectancy was proven the only significant predictor in preservice teachers' intention to use ICT, it is important that future research focuses on this construct. The mean response for effort expectancy on the UTAUT surveys was 5.16

(out of 7), indicating that there is room for improvement within this construct. Future research should seek to discover the factors that predict effort expectancy. Effort expectancy may even be influenced by other constructs from within the UTAUT model. It is possible that social influence may affect effort expectancy: preservice teachers' effort expectancy could be affected by the opinions that others express about the ease of use of ICT. The participants could be influenced by other preservice teachers, university faculty, K-12 supervisors, teachers, or students. Or perhaps facilitating conditions feeds into effort expectancy and the preservice teachers feel that they are unable to use ICT because they do not have the necessary resources. These questions all need to be addressed in future research within this area.

Social influence

The social influence construct had the lowest correlation with behavioral intention (.26). Venkatesh et al. hypothesized that social influence would have a significant influence on behavioral intention, and would be moderated by gender, age, and voluntariness of use. This hypothesis did not hold true in the current study. The mean response for the social influence construct was 5.13 on the UTAUT surveys. In order to ensure item reliability, items 5 ("In general, senior K-12 school officials would support the use of technology in the K-12 classroom") and 9 ("Senior K-12 school officials would be helpful in the use of technology for teaching in the K-12 classroom") were removed from the construct of social influence. This left only items 14 ("People who are important to me would think that I should use technology for teaching in the K-12 classroom") and 19 ("People who influence my behavior would think that I should use technology for teaching in the K-12 classroom"). In future uses of the UTAUT survey in the field of education, researchers might consider rewording these two items. The statement "people who influence my behavior" may have been too vague to elicit appropriate responses from the participants. It may be necessary to specify the people to consider when answering these questions.

Facilitating conditions

Facilitating conditions correlated significantly with behavioral intention, with a coefficient of .37. This construct had a mean response of 4.80. Venkatesh et al. hypothesized that facilitating conditions would not have a significant influence on behavioral intention, and this statement held true in the current study. In order to ensure item reliability, item 16 ("Using technology for teaching in the K-12 classroom would not be compatible with other teaching responsibilities that I have") was dropped from the construct. Preservice teachers may have had difficulties responding to this statement, since they had not yet begun their practicum teaching, and likely were not completely aware of their teaching responsibilities and how technology could be incorporated into their lessons.

Voluntariness of use

The mean response for voluntariness of use was 4.47. Voluntariness of use was not a significant moderator in this study. As discussed previously, the majority of the preservice teachers believed that the use of ICT would be voluntary. This is a difficult area because although the curriculum documents indicate that ICT skills should be integrated throughout the K-12 curriculum, teachers are not held accountable for this

inclusion. It is up to the individual teacher whether they include ICT in their lessons, and this is not typically monitored by an outside individual or organization. This makes voluntariness of use a difficult construct to measure.

Behavioral intention

The mean response for the behavioral intention construct was 5.92, indicating a high intention of the participants to use ICT during their practicum teaching. The only significant moderator was age: intention to use ICT decreases as the participant age increases. The multiple regression model explained 27% of the variance in intention, and found that effort expectancy is the only significant predictor of preservice teachers' intention to use ICT.

Venkatesh et al. found that the UTAUT model explained 70% of the variance in user intention when applied within the business environment. There are a few possible explanations for the lower R^2 that was calculated in the current study. First, the sample size used here was small, consisting of only 82 UTAUT surveys. There is also the possibility of response bias: those with low intention to use ICT may have chosen not to complete the survey. This leads to a sample population with a very high overall intention to use ICT, meaning that there is less variance to explain. One final consideration is that perhaps intention is not an appropriate variable for this population. Intention is extremely difficult to measure, as it is a constantly changing variable. After spending a few weeks in their practicum school, the preservice teachers' intention to use ICT could change completely. This will hopefully be addressed in the long-term version of this study, where the participants will be contacted after one month and three months of practicum teaching, and asked for both intention and usage data.

Implications for future research

This study has shown that effort expectancy is a significant predictor of preservice teachers' intentions to use ICT in their practicum teaching. Future research must now determine specific interventions to increase effort expectancy. Future experimental research studies can test various interventions in order to discover what teacher education programs can do to increase preservice teachers' effort expectancy.

It is likely that the primary measure of effort expectancy is the technology skill level of the preservice teachers. It would be beneficial to researchers to measure this, but because of the subjectivity of this variable, it would be difficult. Individuals who are proficient at simple ICT tools (e-mail, word, etc.) may rate themselves as high skill level, whereas those students that are more advanced in their ICT knowledge will be aware of the tools out there that they aren't comfortable with yet, and may rate themselves lower. In reality, these individuals should be rated with a high technology skill level. In order to avoid this issue, each individual should be given a performance/skill test, but this may be difficult to organize and administer in reality.

Future research should also examine any other factors that may have been omitted from this investigation that may account for some of the variance in user's intentions. Perhaps some of the other UTAUT constructs (such as facilitating conditions and social influence) may contribute to the effect of effort expectancy on intention, as discussed earlier. Future research must also consider whether behavioral intention is the appropriate dependent variable for examining this problem. Intention is a dynamic

variable that changes constantly. Perhaps usage should be examined instead, or inservice teachers should be used as a sample population. Teachers who have completed their first year of teaching at a high school would have a better understanding of the demands, their students' needs, and the technology and resources available to them. Their responses for the intention variable may be more accurate than preservice teachers who have not yet left the university setting.

The researchers also recommend that future studies consider the use of a specific technology when asking preservice teachers to reflect on their intention to use ICT. Although previous studies have used the general term 'technology', we feel that it may be beneficial to identify a specific technology. The use of the general term 'technology' also causes difficulty with the experience measure. In the business context, employees are introduced to a new system, and the UTAUT model is used to examine their acceptance. All employees begin with no experience with the technology. In education, if technology is used as a general term, it is difficult to measure the participants' initial experience, as each teacher's experience level will range from no experience to many years. Alternatively, researchers do not have the funding or means to deploy enough technology in an experimental manner to teachers to start all participants at the same level of experience. The UTAUT model has been very successful in the business sector, and it should be explored further as a possibility in education, with the provision that in future research the model is revised as per the suggestions above, and then tested along-side other prominent technology acceptance models to determine whether the UTAUT can work in the education field, and how it stands compared to other models.

Educational importance of the study

The study's findings have important implications for teaching and learning. Since effort expectancy was found to be the only significant predictor of preservice teachers' intentions, this must be our focus in teacher education. Preservice teachers need to be shown that it is possible for them to use ICT and integrate it into their lessons without too much difficulty. They need to learn the basics of the technologies that will be most useful to them and their students, and be shown ways effectively and easily to integrate these into their future classrooms. The next step is to determine what interventions would help to increase the effort expectancy of preservice teachers.

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Appendix 1. The UTAUT survey

Preservice teachers' acceptance of information and communication technology integration in the classroom: Applying the Unified Theory of Acceptance and Use of Technology (UTAUT) model

The UTAUT SurveyStudy URL: <http://www.educ.uvic.ca/tie/utaut/>

Important: When completing the survey, please keep in mind that we are using a definition of technology which encompasses computer hardware (e.g. scanners, cameras, videoconferencing tools), software applications (e.g. word processing, Excel, Internet, PowerPoint, webpage construction) and any technology specific to your teaching area.

Please circle the number that best describes your agreement or disagreement with each statement.

1	2	3	4	5	6	7
Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree

	1	2	3	4	5	6	7
EE: My interaction with technology for teaching in the K-12 classroom would be clear and understandable	1	2	3	4	5	6	7
PE: Using technology for teaching in the K-12 classroom would enable me to accomplish tasks more quickly	1	2	3	4	5	6	7
BI: I am determined that I will use technology for teaching in the K-12 classroom during my 3-month teaching practicum	1	2	3	4	5	6	7
Vol: Although it might be helpful, using technology for teaching in the K-12 classroom would certainly not be compulsory in my job	1	2	3	4	5	6	7
SI: In general, senior K-12 school officials would support the use of technology in the K-12 classroom	1	2	3	4	5	6	7
EE: I would find using technology for teaching in the K-12 classroom easy to do	1	2	3	4	5	6	7
BI: I plan to use technology for teaching in the K-12 classroom during my 3-month teaching practicum	1	2	3	4	5	6	7
EE: It would be easy for me to become skilful at using technology for teaching in the K-12 classroom	1	2	3	4	5	6	7
SI: Senior K-12 school officials would be helpful in the use of technology for teaching in the K-12 classroom	1	2	3	4	5	6	7
PE: Using technology for teaching in the K-12 classroom would increase my productivity	1	2	3	4	5	6	7
Vol: My boss (principal) would not require me to use technology for teaching in the K-12 classroom	1	2	3	4	5	6	7
PE: If I use technology for teaching in the K-12 classroom, I will increase my employment opportunities	1	2	3	4	5	6	7
EE: Learning to use technology for teaching in the K-12 classroom would be easy for me	1	2	3	4	5	6	7

(Continued).

	1	2	3	4	5	6	7
SI: People who are important to me would think that I should use technology for teaching in the K-12 classroom	1	2	3	4	5	6	7
Vol: My superiors would not expect me to use technology for teaching in the K-12 classroom	1	2	3	4	5	6	7
FC: Using technology for teaching in the K-12 classroom would not be compatible with other teaching responsibilities that I have	1	2	3	4	5	6	7
FC: A specific person (or group) would be available for assistance with difficulties when using technology for teaching in the K-12 classroom	1	2	3	4	5	6	7
PE: I would find using technology for teaching in the K-12 classroom useful	1	2	3	4	5	6	7
SI: People who influence my behavior would think that I should use technology for teaching in the K-12 classroom	1	2	3	4	5	6	7
FC: I have the knowledge necessary to use technology for teaching in the K-12 classroom	1	2	3	4	5	6	7
BI: I intend to use technology for teaching in the K-12 classroom during my 3-month teaching practicum	1	2	3	4	5	6	7
Vol: Using technology for teaching in the K-12 classroom would be voluntary (as opposed to required by superiors/job)	1	2	3	4	5	6	7
FC: I have the resources necessary to use technology for teaching in the K-12 classroom	1	2	3	4	5	6	7

Note: PE, performance expectancy; EE, effort expectancy; SI, social influence; FC, facilitating conditions; BI, behavioral intention. The struck out items were removed from the analysis.

Gender: _____ male _____ female

Age: _____ years

Thank you for your participation and time.

Please:

- (1) Submit the survey to the researcher at the front of the room, OR
- (2) Take the survey home with you and return it to Dr. Valerie Irvine's mailbox, Curriculum and Instruction Department Office, A430 MacLaurin OR
- (3) Complete the survey online at <http://www.educ.uvic.ca/tie/utaut/> BY November 30, 2008