Attitudes of educators to the introduction of mobile technology

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Abstract

Mobile technology offers a wide range of possible opportunities in the educational context. The portability and low cost of mobile devices, compared to computers, have enabled interaction and learning to take place anywhere and anytime. Mobile learning is a relatively new area of interest and many early researchers report a range of advantages and possibilities of using mobile devices in schools and tertiary institutes. However, as with the inclusion of all new technology into a new context, it is important to consider the possible barriers and resistance that may result from the introduction of new technology. This paper discusses the results of a survey conducted at one of the largest polytechnic in New Zealand. The survey was aimed at collecting educators' attitudes to mobile learning, to determine what factors influence their potential adoption of mobile technology into the educational setting. The survey adopted the Technology Adoption Model (TAM) which was used to assess the perceived usefulness and usability of mobile technology used to support teaching and learning.

Keywords

Mobile technology, adoption, mobile learning, educators' technology use

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Introduction

The term mobile learning (m-learning) refers to the use of mobile and handheld devices, such as Personal Digital Assistants (PDAs), mobile telephones and MP3 players, in supporting teaching and enabling learning. As computers and the Internet become essential educational tools and the technology becomes more portable, affordable, effective, and easy to use, so too have they become the focus on how they can be incorporated to support learning. These technologies provide many opportunities for widening participation and enable easier access to learning. Mobile devices such as phones and PDAs are more reasonably priced than desktop computers, and therefore, present a less expensive method of accessing a myriad of tools all in one small device. Features such as the facility to make phone calls, take pictures, record audio and video, store data, music, and movies, and interact with the Internet all provide opportunities that could be harnessed in the educational context. As new devices continue to enter the market, new features and capabilities are appearing at an accelerated pace. Mobile learning offers a fundamental change in the way learning can be regarded and opens the door to countless uses for educational purposes.

The decision of educators to integrate mobile learning into their teaching is a complex process with a wide number of influencing factors. A key question in trying to determine future adoption with the technology environment is determining why an individual would adopt one technology while resisting another. According to Straub (2009, p.626) "technology adoption is (a) a complex, inherently social, developmental process; (b) individuals construct unique (but malleable) perceptions of technology that influence the adoption process; and (c) successfully facilitating a technology adoption needs to address cognitive, emotional, and contextual concerns". The aim of this paper is to provide an initial insight into some of these factors that may affect the adoption of mobile technology into education. In addition this paper will assess the attitudes these educators have concerning the introduction of mobile technology into the educational context.

Technology adoption in education

User acceptance can be defined as "the demonstrable willingness within a user group to employ information technology for the tasks it is designed to support" (Dillon & Morris, 1996, p.5). Therefore, in terms of this paper, user acceptance is the willingness of educators to use their mobile devices to support their teaching. Interest is focused on identifying the factors that influence the adoption of technologies by users who have some degree of choice. A high number of models and theories have arisen which aim to uncover the factors that will influence the adoption of technology. These factors range from focus on the technology itself through to the psychological characteristics of the individual (see Dillon and Morris, 1996 for a detailed review of various theories and models of user acceptance). Due to the wide ranging issue of why an individual would accept or reject a technology it is unlikely that a single-variable explanation could account for this decision. However, a number of theories and models have been developed to help understand adoption and have been used to explain adoption in the educational context.

One of the most popular models which have been used extensively in IS literature is the Technology Acceptance Model (TAM). The TAM has been used to

explain the adoption of a wide range of technologies and has been used in the educational contexts to explain a wide range of educational tools (Ma, Andersson & Streith, 2005; Hu, Clark, Ma, 2003; Ngai, Poon & Chan, 2007). The TAM focuses on two main constructs, namely the perceived ease of use (PEOU) and usefulness (PU) of the technology as perceived by the intended user. Research has shown that the TAM model can be used to explain approximately 50% of the variance in acceptance levels (Davis, Bagozzi, & Warshaw, 1992). A number of studies have used the TAM model as a basis to describe the adoption of mobile technology by educators and students (Huang, Lin & Chuang; 2007, Carlsson et al., 2006). Huang, Lin & Chuang (2007) adopted the TAM to explain the adoption of mobile learning by students. Their study shows that that perceived usefulness (PU) and perceived ease of use (PEOU) are key determinants of user perception of m-learning, however the usefulness of mobile technology was a vital characteristic of adoption. Liu (2008) adapted the TAM model by including four additional variables that, he felt, better helped determine mobile learning adoption, namely: performance expectancy, effort expectancy, social influence and facilitating conditions. These additional variables stemmed from Carlsson et al. (2006) who stated that "mobile technology adoption is more individual, more personalized and focused on the services made available by the technology". Other authors have used a number of other variables in addition to PEOU and PU to help explain mobile learning adoption these include: the measurement of enjoyment (Phuangthong & Malisawan, 2005), self-efficacy (Lee, Kim, & Chung, 2002; Pedersen, 2003; MacCallum & Jeffrey, 2009) access to resources (Pedersen, 2003), image (Teo & Pok, 2003), and motivation (Kwon & Chidambaram, 2000; MacCallum & Jeffrey, 2009).

The addition of a wide variety of other variables used to support the TAM model has resulted in a rather complex list of possible variables that can be used to explain adoption. In addition, to the modifications made to the TAM model, other models and theories have also been adopted to help explain the adoption of technology, such as the Diffusion of Innovation Theory (Rogers, 2003), Theory of Reasoned Action (Fishbein & Ajzen, 1975), Theory of Planned Behavior (Ajzen, 1991). The wide varieties of possible models and subsequent modifications to these models have made it difficult to select an appropriate and verifiable model that can be relied on to truly help interpret the adoption process. Therefore, recently Venkatesh et al. (2003) set out to develop a unified theoretical model that captures the essential elements of all these theories and models. The resulting Unified Theory of Acceptance and Usage Theory (UTAUT) has brought eight adoption models and theories, namely, Diffusion of Innovation, Theory of Reasoned Action, Theory of Planned Action, Technology Acceptance Model, Combined TAM and TPB, Motivational Model, Social Cognitive Theory, Model of PC Utilization, with the aim of creating one robust model.

The original version of the UTAUT contained seven constructs (effort expectancy, performance expectancy, social influence, facilitating conditions, attitude, self efficacy and anxiety) however only four constructs were found to have a significant relationship with adoption. These constructs are performance expectancy, effort expectancy, social influence and facilitating conditions. In addition, to the above, constructs age, gender,

experience and voluntariness of use were also considered to be of significance when assessing adoption. In Venkatesh et. al., (2003) in a longitudinal study they found that the UTAUT accounted for 70% of the variance in usage intention.

This study utilizes the Technology Acceptance Model to help interpret the attitudes of educators' to the introduction of mobile technology into the tertiary environment. The following outlines the methodology adopted and the results of the survey.

Methodology

An online survey was developed based on the instrument developed by Venkatesh, et. al. (2003). The participants of this study were instructors teaching at one of the larger polytechnics in New Zealand. Data was collected at the end of 2009. A total of 52 surveys were received however a number of these were later rejected due to missing sections, resulting in total of 38 responses. Due to the small number of responses received the results in this study are only meant to be exploratory rather than determine a significant relationship between the constructs measured in this survey.

The respondents in this survey comprised of 44.7% were male and 55.3% were female. The majority of the participants fell into the over 50 age category (n= 25), with 8 participants between the ages of 40 and 49. Only 5 participants were below the age of 40. The participants taught in a wide range of faculties, however most came from the Business and Computing, Art and Social Science and the Science and Technology faculties. These results were consistent with the institute's demographics. Table 1 provides a summary of the participants' reported faculty.

Of these participants all, except two, had a mobile phone and most (74%) carried the phone with them at all times. The majority of the mobile devices were considered by the respondents to be at the low-end of the scale where text and making calls the only feature of these phones. Only 11% of these participants considered their phones to be high-end phones. Table 2 gives a breakdown of the number of participants and the self reported mobile phone types. In addition, when comparing how likely the participant was to have the mobile device with them and the type of mobile device, those that stated that they had a lower end mobile device were more likely not to have a mobile device or regularly left it at home.

Table 1: Faculty Composition

Faculties	Frequency	Percent
Business and Computing	12	31.6%
Arts and Social Science	9	23.7%
Science and Technology	9	23.7%
Health and Sport Science	5	13.2%
Te Manga Maori	1	3%
Other	2	5%

Table 2: Mobile phone type

Mobile	Frequency	Percent
Low End: I can only text and make calls	11	28.9
	8	21.1
	9	23.7
	4	10.5
High End: Fully functional smart device with all the latest features	4	10.5

The survey was based on UTAUT model. Typically the UTAUT and similar models are used after a user has used the tool or technology in question. The participants in this survey have not been involved in any mobile learning initiative, however all have used a mobile device, therefore the wording of the survey was change to represent this slight shift in concept. The adoption of this model was still considered as suitable as many of the concepts with which the UTAUT covers can still be assessed. The concept behind using the UTAUT was to determine what factors would possibly impact the future adoption of mobile learning by educators. The results of the UTAUT would be assessed in conjunction with other variables (such as age, gender, computing experience, motivation, etc) to determine the impact these variables have on the UTAUT constructs. Due to the length constrains of this paper the wider context of the adoption will not be discussed however this paper will focus on the overall results of the five measured constructs and discuss the insights that this provides. These results gave significant insight to the possible future adoption of mobile learning as a whole however these results could not guarantee the same results when implementing select mobile learning facilities. Figure 1 outlines the five constructs which are measured in this study. The appendix contains the actual questions used in this study.

One construct that was left off the UTAUT was the scale of 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., 2003, p451). The reason for not including this construct in this survey, relates the fundamental shift of this survey. Since mobile learning is still an emerging tool and significant barriers (such as cost) impact on the probable introduction of mobile learning in any significant way in the immediate future therefore the likely social influence may not be as relevant here compared to other technologies.

Most people are not using mobile technology in there teaching therefore the pressure of others to adopt would be significantly less. In addition, the construct relating to attitude was left in this survey, as mentioned previously, Venkatesh, et. al. (2003) found that attitude had no significant influence on future use of technology and was therefore dropped from the final version of the UTUAT. In this study it was decided that this construct should be included as attitudes seem to play a big role in the likeliness of people wanting to adopt mobile technology in their teaching. Anecdotally, when discussing mobile learning with instructors the researcher has found that instructors typically have either have a strong favourable or negative attitude to mobile learning. These attitudes seldom change and would possibly be a big factor in the future adoption of mobile learning by instructors.

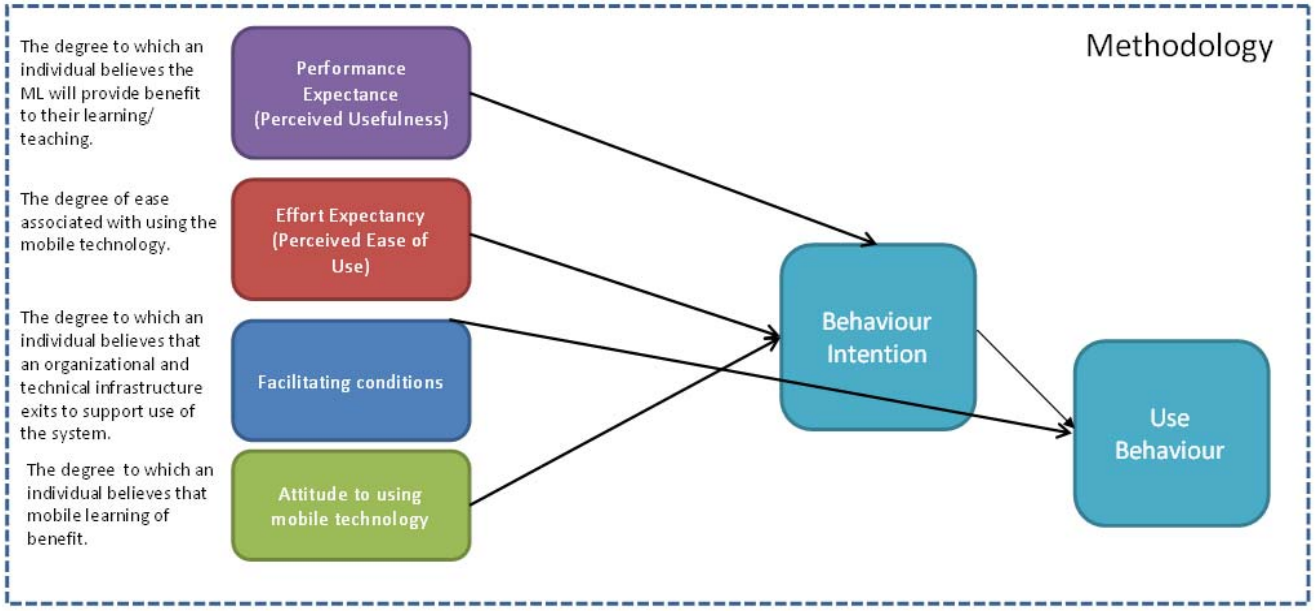

Figure 1. UTUAT Model used in this study

To help provide an insight to the reliability of the questions used to measure the five outlined construct a reliability analysis was conducted for the scales using Cronbach's Alpha. As summarized in Table 3, all except one of the scales that represent the UTAUT constructs appear to have a good degree of reliability since each computed statistic is above .70 (Nunnally 1978). The Facilitating Conditions construct falls slightly below this value with an alpha of .620, however since this is not very far below the .70 level recommended by Nunnally (1978), the construct will still be considered

Results

The results of the survey were analysed to determine whether the identified constructs (performance expectancy, effort expectancy, facilitating conditions, attitude, and behavioural intention) had any significant relationship to age, gender, faculty, how often they carry their mobile and the type of mobile.

The table in the appendix provides a summary of a Spearman correlation analysis to test the relationships among the UTAUT constructs. The significance of this correlation statistic needs to be considered as only an

indicator of a possible relation between variables, due to the relative small size of this sample.

Table 3: Reliability Analysis (n=39)

UTAUT Construct	Cronbach's Alpha	Number of Items
Performance Expectancy	.922	7
Effort Expectancy	.758	5
Facilitating Conditions	.620	3
Attitude Towards Using Technology	.863	4
Behavioral Intention	.743	4

Overall, the results show us there is an overall strong relationship between the UTAUT constructs, where all these constructs relate and influence each other. On the other hand, there seems to be little evidence that the external variables seem to influence the results of the UTAUT, except when we consider age and effort expectancy. The initial results show that typically older respondents are more likely to worry about the level of effort needed to be expended to learn how to use mobile technology to support their teaching. This is consistent with the findings in Venkatesh and Morris (2000) where effort expectancy was most prominent for older workers. The interpretation of this result, in our study, needs to considered with some reservations since most of the respondents in this study fell in the above 50 age group. Table 4 provides a crosstab of the relationship between age and effort expectance.

Table 4: Effort Expectance (EE) and Age (n=39)

EE	Age			
	20 – 29	30 – 39	40 – 49	over 50
1	.0% (n=0)	.0% (n=0)	100.0% (n=1)	.0% (n=0)
2	.0% (n=0)	.0% (n=0)	.0% (n=0)	100.0% (n=6)
3	.0% (n=0)	11.1% (n=1)	.0% (n=0)	88.9% (n=8)
4	8.3% (n=1)	16.7% (n=2)	25.0% (n=3)	50.0% (n=6)
5	.0% (n=0)	.0% (n=0)	66.7% (n=4)	33.3% (n=2)
6	.0% (n=0)	8.3% (n=1)	.0% (n=0)	66.7% (n=2)
7	.0% (n=0)	.0% (n=0)	.0% (n=0)	.0% (n=0)

Table 5 outlines the means and standard deviations of the educator's perceptions of adoption mobile learning. Overall the results show that the instructors are relatively positive towards the idea of the introduction of mobile learning.

Table 5: Summary of results of UTAUT constructs (n=39)

UTAUT Construct	N	Min	Max	Mean	Std Dev
Performance Expectancy	38	2	7	5.13	1.234
Effort Expectancy	37	1	6	3.68	1.248
Facilitating Conditions	36	1	7	4.28	1.466
Attitude Towards Using Technology	36	2	7	5.31	1.117
Behavioral Intention	37	2	7	4.51	1.193

When considering the performance expectancy, participants overall slightly agreed with the seven statements that made up this measure. As can be seen the instructors tend to believe that mobile technology is a useful and productive tool; however, they tend to be a bit more neutral in terms of their perception that this technology would help them achieve tasks more quickly. Table 6 summarizes the mean and standard deviation of the instructors' perceptions with respect to performance expectancy.

Table 7 provides a descriptive analysis of the instructors' perceptions regarding effort expectancy. It appears that the instructors tend to agree that mobile learning would be easier to use and that they would probably find it comfortable to use in front of others, however participants felt that using mobile technology may require a significant amount of time to set up and support.

Table 6: Performance Expectancy

Performance Expectancy	N	Min	Max	Mean	Std Dev
I see ML as a way to enhance/encourage my students self-directed learning	36	2	7	5.36	1.199
I believe MT offers increase accessed to leaning material by my students	36	1	7	5.22	1.396
I see Mobile Learning (ML) as a way to offer more flexibility to my students compare to e-learning	37	1	7	5.16	1.344
I see ML as a way to improve student learning as it allows students to access learning content anywhere and anytime	37	1	7	5.16	1.405
I see ML as a way of encouraging more interaction by students and educators	36	2	7	5	1.454
I would find mobile technology (MT) useful in my teaching	37	1	7	4.92	1.552
I believe that using MT would enable me to accomplish tasks more quickly	36	1	7	4.39	1.712

Table 7: Effort Expectancy

Effort Expectancy	N	Min	Max	Mean	Std Dev
I believe I would find it easy to use a mobile device to support my teaching	38	2	7	5.13	1.234
I would feel uncomfortable about using MT in front of others in case I am unable to work it correctly*	38	2	7	5.13	1.234
I think it might take me a while to get comfortable with using a mobile device for teaching*	35	1	7	4.4	1.735
I would be anxious about having to use my mobile device to help support my learning*	32	1	6	3.53	1.524
ML requires too much time to support and setup*	36	1	7	2.89	1.508

* Items have been recoded

When assessing the possible relationships between variables the Spearman correlation analysis hinted towards a possible relationship between the age and attitude towards the facilitating conditions of mobile technology. In table 8 it can be seen that overall the instructors believe that mobile learning would be compatible to teaching however they feel that they do not necessarily have the knowledge to implement this into their teaching.

Table 8: Facilitating Conditions

Facilitating Conditions	N	Min	Max	Mean	Std Dev
ML would not be compatible with how I teach	34	1	7	4.94	1.757
I believe that I would need a strong level of support from the IT staff to help me with setting and using the technology	36	1	7	4.28	1.466
I feel that I would have the knowledge necessary to implement and use MT in my teaching*	35	1	6	3.46	1.482

* Items have been recoded

Table 9 presents a summary of the overall attitudes of the instructors' in regard to their view of mobile learning. Overall on average there seemed to be an

overall positive response to mobile learning. Figure 2 gives a more detailed summary of the frequency of the individual responses on the 7 point Likert scale.

Table 9: Attitude Towards Using Technology

Attitude Towards Using Technology	N	Min	Max	Mean	Std Dev
Working with the MT will be fun.	36	2	7	5.31	1.117
Using MT for learning/teaching is a good idea.	35	1	7	5.26	1.245
MT will make learning and teaching more interesting.	35	1	7	5.23	1.190
MT will increase student's interest	36	1	7	4.92	1.610

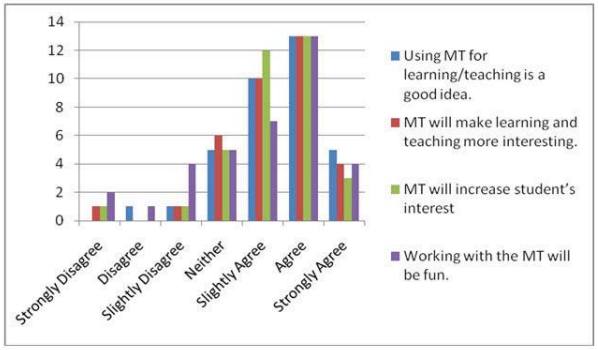

Figure 2. Attitudes towards using mobile learning

The last construct helped interpret the intention of the instructors on possibly adopting mobile technology to support their teaching sometime in the future. Table 10 shows that overall instructor were interested in using mobile technology however they felt that they needed to see others adopt and see the benefits before this would happen.

Table 10: Behavioural intention

Behavioural intention	N	Min	Max	Mean	Std Dev
Overall I would be interested in including ML if I had the opportunity in the future	36	1	7	4.86	1.533
I do not think I will implement ML until I have see other educators using it successfully *	37	2	7	4.51	1.193
ML is too expensive in terms of the cost of the devices, services, maintenance repair and upgrades, and support from an IT etc *	34	1	7	3.74	1.831
I can see how I could incorporate ML it into my teaching	29	1	6	3.45	1.478

* Items have been recoded

Conclusions

This study describes the results of small scale initial study into a group of educators and their perceptions of using mobile technology to support their teaching. The foundation of this study was based on the UTAUT model. This model helped identify constructs such as performance expectancy, effort expectancy, facilitating conditions, attitude, and behavioural intention as possible indicators to the future adoption of mobile learning.

Since this is a small scale study, no real relation was shown on these constructs based on gender, faculty and mobile use. However, some support was shown that indicated that age may be a factor in regards to the perceived effort which would need to be placed into setting up any mobile facility. This result was only perceived as an indicator of a possible relationship since the sample size was very small.

Overall the participants' attitude to mobile learning was largely positive however issues such as the time to set up this tool and the knowhow were major issues that may affect the overall future adoption of mobile learning by educators. Educators will need support and

help with determining the best way to use mobile technology before they are willing to adopt. In addition mobile learning needs it champions to show how mobile technology can be used and the benefits it brings to students and teachers alike. The concept of observability, as discussed by Rogers (2003), seems to be a key issue to the future adoption of mobile learning. Rogers (2003) define observability being where the innovation uses and effects being visible to other. The introduction of mobile learning must be visible and the effects that it has on learning must also be visible or enthusiasm for the tool would wane. Wide research and long term studies are need to truly represent the true value of mobile learning. Currently most studies focusing on mobile learning are short term and limited in focus, therefore, failing to provide concrete and ongoing benefit.

Overall, this study has help give an initial insight to the attitudes and possible future adoption of mobile technology by educators. The next step of this study will be to broaden the scope of the survey to incorporate a wider audience of tertiary educatory therefore help provide more generalisable results.

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Appendix: Spearman correlation results

	Gender	Age	Faculty	Often phone carried	Type of phone	PE	EE	FC	A	BI
Gender	1.00									
Age	.112 .503	1.00								
Faculty	-.176 .296	.174 .304	1.00							
Often phone carried	-.044 .795	.063 .708	-.143 .398	1.00						
Type of phone	-.030 .860	-.092 .593	.075 .670		1.00					
Performance Expectancy (PE)	.139 .405	.073 .665	-.033 .847	.017 .921	.126 .465	1.00				
Effort Expectancy (EE)	.058 .734	.329* .047	.199 .245	-.062 .714	-.281 .101	-.446** .006	1.00			
Facilitating Conditions (FC)	.135 .432	.272 .109	.229 .180	-.245 .150	-.298 .087	-.375* .024	-.375* .024	1.00		
Attitude Towards Using Technology (A)	.124 .471	.015 .933	-.007 .967	-.039 .820	.160 .366	.796** .000	-.398* .016	-.240 .159	1.00	
Behavioural intention (BI)	.190 .260	-.214 .204	-.127 .461	.169 .318	.173 .320	.623** .000	-.669** .000	-.701** .000	.549** .001	1.00

** 2-tailed Significance at .001; * 2 tailed significance at .05.