Technology Acceptance by In-Service Teachers in Hong Kong - Preliminary Results

Gary Ka-Wai Wong & Ho-Yin Cheung
Hong Kong Institute of Education, Hong Kong, China
Graduate School of Education, University of Bristol, United Kingdom

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Abstract
Educational technology is appealing to some educators due to its potential in supporting a larger variety of pedagogy. Since 1998, the government in Hong Kong has been making continuous investment into the ICT infrastructure and staff training in local public schools to support the use of ICT for teaching and learning enhancement. It is nevertheless our observation that teachers have their own considerations when it comes to using technology in their own teaching and they are not always supportive. This paper presents part of our quantitative study of technology acceptance of a group of in-service primary school teachers in Hong Kong. The key factors leading to the teachers' behavioral intention of use of these technologies are found using multiple-regression as a preliminary analysis. The results show that (1) in-service teachers in Hong Kong rely heavily on attitude and facilitating conditions when they decide on the adoption or non-adoption of technology in their teaching, while the perceived usefulness and perceived ease of use are considered less important; and (2) they have relatively low rating on perceived usefulness and perceived ease of use of the technology, and most noticeably on the facilitating conditions available to their school despite the government's long-term investment. The implications of these results are discussed.

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Introduction

Educational technology is compelling to educators all over the world for its potential revolutionary impact on teaching and learning. In Hong Kong, the government has been making continuous investment via three stages of Strategies on Information Technology in Education (Education Bureau, n.d.) since 1998 to develop the ICT infrastructure to facilitate the use of educational technologies in local public schools. A recent report by the Educational Bureau of Hong Kong shows that primary teachers are generally confident and experienced with ICT in education (Education Bureau, 2012). The same report also indicates that local schools are equipped with the necessary ICT infrastructure for this development.

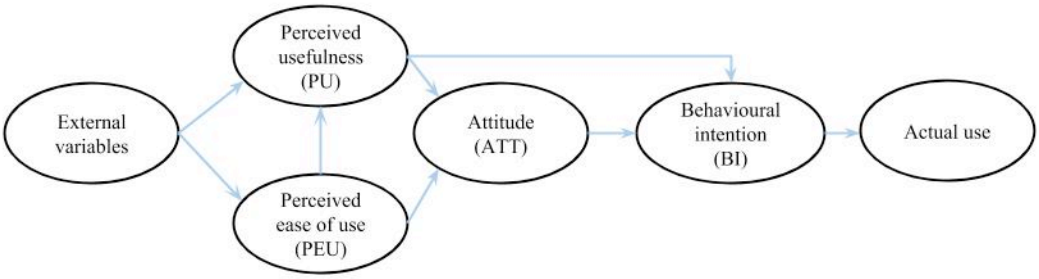
Nevertheless, it is our observation that not all teachers are putting ICTs to full use. Instead, many seem to be reluctant to incorporate ICT into their teaching unless they feel they are well supported by their corresponding school. Time constraint also seems to be another issue. This echoes with some existing research, which suggests that in case of voluntary use, teachers are selective in ICT adoption based on pragmatic considerations such as time and resources. Besides, they often consider ICT to be unnecessary, time-consuming, inflexible, and difficult to use, thus they prefer to use it only selectively (West, Waddoups, & Graham, 2006).

To confirm this observation and gain a deeper understanding of the phenomenon, a research project is being conducted to collect and analyze data from local primary school teachers to investigate the factors contributing to the technology acceptance of these teachers. The study uses structural equation modeling to find the relation between these factors, while the present paper reports the results of the preliminary step to use multiple-regression to identify the important factors, which serves to inspire model building in the next stage.

A Brief Description of Related Works

Existing research on technology acceptance is mostly quantitative. Theoretical models are built to propose the relations among various possible factors. These models are then empirically verified using statistical data collected via questionnaire. One of the most popular models is the Technology Acceptance Model (TAM) originally developed by Davis (1985). This model is based on two other theories in psychology: the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1977) and the Theory of Planned Behavior (TPB) (Netemeyer, Ryn, & Ajzen, 1991). To put it simple, the TAM adapts TRA and TPB in the context of ICT adoption in education. It assumes that the intension of a person to adopt ICT in education depends on his/her attitude towards the behavior. This attitude in turn relies on the perceived usefulness and perceived ease of use of the technology. These two factors are further influenced by a number of external variables, including computer self-efficacy, facilitating conditions, and subjective norm. Here computer self-efficacy refers to the confidence of the person that he/she can tackle the difficulties in using the technology. Facilitating conditions relates to time, resources, and knowledge that facilitate the use of the technology. Finally, subjective norm refers to how the person thinks their peers or the society think they should behave. The TAM is illustrated in **Figure 1**.

Figure 1: Technology Acceptance Model (Davis, 1985)



The TAM is not the only model used in this field of research. In fact, most researchers apply customizations to the model by introducing new variables or altering the structure of the model to fit their particular needs. See, e.g. Legris, Ingham, & Collerette (2003) for a comprehensive review of studies using TAM and its variants to approach the problem.

Later, Venkatesh et al. (2003) combined eight of the more prominent models, including TAM, to form a new, unified model named Unified Theory of Acceptance and Use of Technology (UTAUT). This theory postulates that performance expectancy (perceived usefulness), effort expectancy (perceived ease of use), social influence (subjective norm) and facilitating conditions are the key factors of behavioral intention. These factors are also moderated by gender, age, experience, and voluntariness of use. A review on studies using UTAUT can be found in Taiwo & Downe (2013).

Because of the freedom to customize the model according to the needs of the individual authors, two studies seldom use completely identical models. Empirically, they also produce diverse results. To cite some examples, Yuen & Ma (2008) surveyed 152 teachers in Hong Kong taking part-time postgraduate diploma in education and showed that perceived ease of use was the key factor to behavioral intention, while perceived usefulness had no significant effect. As for external variables, they showed that subjective norm and computer self-efficacy acted on perceived ease of use to affect behavioral intention. Another study by Wang & Wang (2009) using 268 university instructors in Taiwan somewhat produced inconsistent results. They found that perceived ease of use only had a weak influence, while subjective norm and perceived usefulness were the dominating factors of behavioral intention. Another study by Chen & Tseng (2012), also conducted in Taiwan but on 402 junior high school teachers, showed that perceived usefulness and perceived ease of use possess the strongest effect on behavioral intention.

The diverse results are not only due to different model used but also due to the different contexts. Cross-cultural studies show that both national and professional culture can have significant influence on technology acceptance (Nistor, Lerche, Weinberger, Ceobanu, & Heymann, 2012; Sánchez-Franco, Martínez-López, & Martín-Velicia, 2009). For this reason, it is often difficult to generalize the findings of one study to other situations in the field of technology acceptance. The present project therefore serves to investigate technology acceptance in the context of primary education in Hong Kong, which has not been covered in existing literature.

Methodology

Model and Instrument

This study uses a multi-regression model for preliminary analysis of the data. The questionnaire instrument has been adapted from Venkatesh et al. (2003) with minimal adjustments to the wordings to fit into our present context. The core section of the questionnaire contains 31 items classified under eight variables as shown in **Table 1**. The information section of the questionnaire then asks the participants about their sex, year of birth, major subject taught, experience using educational technology in workplace, and their voluntariness of use.

Table 1: Constructs and Items used in this Study

Constructs	Codes	Items
Perceived usefulness (PU) (Performance expectancy in UTAUT)	PU1	I find educational technology useful in my teaching.
	PU2	Using educational technology enables me to accomplish teaching tasks more quickly.
	PU3	Using educational technology increases my productivity (i.e. accomplishes more with less effort and time).
	PU4	Using educational technology will increase my chances of getting a promotion.
Perceived ease of use (PEU) (Effort expectancy in UTAUT)	PEU1	My interaction with educational technology is clear and understandable.
	PEU2	It is easy for me to become skillful at using educational technology.
	PEU3	I find educational technology easy to use.
	PEU4	Learning to use educational technology is easy for me.
Attitude (ATT)	ATT1	Using educational technology is a good idea.
	ATT2	Educational technology makes my work more interesting.
	ATT3	Educational technology is fun.
	ATT4	I like using educational technology in teaching.
Subjective norm (SN) (Social influence in UTAUT)	SN1	People who influence my behavior think that I should use educational technology.
	SN2	People who are important to me think that I should use educational technology.
	SN3	The senor management of my school has been helpful in the use of educational technology.
	SN4	In general, the school has supported the use of educational technology.
Facilitating conditions (FC)	FC1	I have the resources necessary to use educational technology.
	FC2	I have the knowledge necessary to use educational technology.
	FC3	Educational technology fits well into my workflow.
	FC4	A specific person or group (e.g. technical support team) is available for assistance with difficulties using educational technology.
Computer self-efficacy (EFF)		I could complete a job or task using educational technology…

	EFF1	… even if there was no one around to tell me what to do as I go.
	EFF2	… if I could call someone for help if I got stuck.
	EFF3	… if I had enough time.
	EFF4	… if I had access to the instruction manuals for the technology.
Anxiety (ANX)	ANX1	I fear about using educational technology.
	ANX2	It scares me to think that I could ruin my teaching using educational technology by making a small mistake.
	ANX3	I hesitate to use educational technology for fear of making mistakes I cannot correct.
	ANX4	Educational technology is somewhat frightening to me.
Behavioral Intention of use (BI)	BI1	I intend to use educational technology in this and the coming semester.
	BI2	I predict I would use educational technology in this and the coming semester.
	BI3	I have actual plan to use educational technology in this and the coming semester

Data Collection

Data were collected mainly from the 21 primary schools subsidized under the "Direct Subsidy Scheme" (DSS) in Hong Kong, while a few non-DSS schools were also invited. The questionnaires together with other supplementary documents were mailed to the principals of these schools in paper form. Participation was voluntary.

In the end, six schools responded to the invitation and returned 206 questionnaires. After data pre-processing, 21 questionnaires were discarded for missing or invalid data. The total number of valid samples used for further analysis was 185.

Data Analysis

The data were analyzed using stepwise multiple-regression (Hocking, 1976) with behavioral intension as dependent variable and all the other seven constructs as independent variables. The regression is stepwise in a sense that initially all the seven independent variables are included in the regression, then the algorithm performs variable selection by iteratively eliminating or adding back variables to minimize the AIC (Akaike, 1974) of the model. This approach helps to determine numerically what variables are necessary to fit the data while eliminating the unnecessary ones. This insight, together with other theoretical considerations, are useful to inspire the building of more complicated models to be analyzed in a later stage using the more sophisticated methods such as structural equation modeling.

Results

Demographic and Descriptive Statistics

Table 2 shows the demographic statistics of the data. It can be seen that the participants vary in terms of age group, subjects taught, experience using educational

technology, and voluntariness of use. The mean, standard deviation, skewness, and kurtosis are shown in
Table 3.

Table 2: Demographic Statistics

Items	Frequency	Percentage
Sex		
Female	135	73%
Male	45	24%
Invalid answers	5	3%
Total	185	100%
Year of Birth		
1960 or before	3	2%
1961-1970	71	38%
1971-1980	74	40%
1981-1990	23	12%
After 1990	11	6%
Invalid answers	3	2%
Total	185	100%
Main subject taught		
Business	2	1%
General education	3	2%
Language	104	56%
Science and mathematics	47	25%
Arts, PE, and others	15	8%
Multiple selected	9	5%
Invalid answers	5	3%
Total	185	100%
Experience with educational technologies		
Never learned about it formally	15	8%
Learned, but not used	19	10%
Learned, and used for at least one semester	144	78%
Invalid answers	7	4%
Total	185	100%
Voluntariness of use		
Completely free to decide	14	8%
Some mandate but otherwise free to decide	61	33%
Mandate in most aspects of teaching	108	58%
Invalid answers	2	1%
Total	185	100%

Table 3: Descriptive Statistics of the Constructs

Construct	Mean	Standard Deviation	Skewness	Kurtosis
Perceived usefulness (PU)	2.96	0.57	-0.32	0.17
Perceived ease of use (PEU)	2.64	0.62	0.03	-0.09
Subjective norm (SN)	3.42	0.54	-0.46	0.58
Attitude (ATT)	3.12	0.50	-0.07	0.49

Facilitating conditions (FC)	2.72	0.52	-0.22	0.38
Computer self-efficacy (EFF)	3.44	0.52	-0.25	1.01
Anxiety (ANX)	2.43	0.84	0.29	-0.48
Behavioral intention of use (BI)	3.23	0.66	-0.13	-0.38

Behavioral Intension by Group

One particular type of descriptive statistics that may be of particular interest is the average scores of behavioral intension by age group and major subject taught respectively. In **Table 4** below, the age groups and major subjects with group size of at least 10 are selected for comparison. One-way ANOVA across different age groups shows that there is no difference between the behavioral intension of participants of different ages to use educational technologies in teaching. One-way ANOVA across different subjects taught show a similar result among participants teaching different subjects. In other words, there is no statistical evidence that participants at different age groups or teaching different subjects have higher or lower behavioral intention than the other groups to use educational technology in their teaching.

Table 4: Comparing Behavioral Intention of Use by Group

Items	Frequency	Mean of BI	Standard Deviation of BI	F-test p-value
Year of Birth				
1960 or before	3	3.00	0.58	
1961-1970	71	3.34	0.64	
1971-1980	74	3.22	0.69	0.166
1981-1990	23	3.01	0.67	
After 1990	11	3.09	0.37	
Invalid answers	3	N/A	N/A	
Total	185			
Main subject taught				
Business	2	3.67	0.47	
General education	3	3.33	0.88	
Language	104	3.20	0.62	
Science and mathematics	47	3.22	0.69	0.103
Arts, PE, and others	15	3.58	0.68	
Multiple selected	9	3.07	0.89	
Invalid answers	5	N/A	N/A	
Total	185			

Results of Multiple-Regression Analysis

Finally, the multiple regression result in
Table 5 shows that only three variables contribute to the behavioral intension to use technology. In particular, only attitude and facilitating conditions demonstrate coefficients significantly different from zero, while the p-value for anxiety is only marginal. The result shows that attitude and facilitating conditions seem to the most

important factors of behavioral intension for the participants in our sample. In contrast, perceived usefulness and perceived ease of use, that many previous studies have found to be important factors, are eliminated from the stepwise regression model in our case.

Table 5: Results of Multiple-Regression (p<0.001: *; p<0.01: **; p<0.05: *)**

Construct	Coefficient	Standard error	p-value	Supported (p<0.05)?
(Intercept)	0.5722	0.3421	0.09608	Not supported
Attitude (ATT)	0.4764	0.0882	2.1e-07***	Supported
Facilitating conditions (FC)	0.3284	0.0885	0.00028***	Supported
Anxiety (ANX)	-0.1014	0.0501	0.04438*	Supported
Subjective norm (SN)	0.1545	0.0784	0.05018	Not supported

Discussions

There are a few interesting points of discussion on the data. First, the result that behavioral intensions is independent of age group and subject taught is counter-intuitive because one may think that younger teachers (especially the digital native born after 1980 (Prensky, 2001)) may have stronger behavioral intension to use educational technology. Teachers of science and mathematics, that are closer to technology in nature than language and other arts subjects, may also be more willing to try new technologies in the workplace. Yet these assertions are not supported by the descriptive statistics.

A possible explanation is that facilitating conditions is one of the dominating factors of behavioral intension. As this construct is mostly independent of age and subject, it may have overridden any effects that may have arisen from these demographic differences. The dominance of facilitating conditions over perceived ease of use and perceived usefulness also shows that teachers are very pragmatic towards the use of technologies, regarding facilitating conditions as an important prerequisite of using the technology.

This does not mean that perceived usefulness and perceived ease of use, that are absent in the final regression model, do not have any effect on behavioral intension, but rather that they may act indirectly through other constructs such as attitude. The attitude represents how much the teachers like the idea of using educational technology at work. This attitude is a combined effect of other effects, and it is shown to be another dominating factor alongside facilitating conditions. To determine how this attitude relies on the other factors requires a more sophisticated statistical method such as structural equation modeling, which is planned in the next stage of the present study.

Finally, descriptive statistics shows that teachers rate below the mid-point on perceived usefulness, perceived ease of use, and all four types of facilitating conditions, despite the long-term investment of the government. It is beyond the scope

of the regression model to explain this phenomenon. One might conduct qualitative interviews with the teachers concerned to seek further explanation.

Conclusions

In conclusion, this study applies multiple-regression to identify the dominating factors of technology acceptance among in-service primary teachers in Hong Kong. The result shows that facilitating conditions and attitude are the two dominating factors of technology acceptance, while perceived usefulness and perceived ease of use are found to be unimportant. Further analysis of the relations between these constructs requires a more sophisticated statistical method, which has been planned in the next stage of our research project.

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