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An Interactive Whiteboard Model Survey: Reliable Development

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Abstract

Applications and practices of interactive whiteboards (IWBs) in school learning is important focus and development trend for developmented countries in recent years. There are rare researches and discussions about IWB teaching materials for course teaching and teaching effectiveness. As for the aspect of academic studies, there is more practical teaching sharing for subjects such as language learning, mathematical learning and physical science learning; however, it is rarely seen empirical research on the application of IWB for educational acceptances of interactive whiteboards.

Based on its imporatances, we summarize previous literatures to establish a theoretical model for interactive whiteboards (IWBs). Variables in this model are then discussed to find out the interaction between each other. The contribution of the study develops an innovative model for educational acceptances of interactive whiteboards using hybrid TAM, ECM, and Flow models.

Keywords: E-learning, TAM, ECM, Flow Model, Interactive Whiteboard, Interactive Whiteboards.

1.Introduction

Lots of countries, such as South Africa, Australia, the United States (US) and the United Kingdom (UK), huge amounts of declared funding has been assigned to education sectors for promoting IWBs in classes, particularly in the school system of K-12 (Hall & Higgins, 2005; Holmes, 2009; Slay et al., 2008; Torff & Tirotta, 2010). The United Kingdom was the first adopter of IWBs in classrooms in the world. A survey shows that almost 98 percent of secondary and all primary schools in the UK used IWBs in teaching in 2007 (Becta, 2008). Associated studies have proven that IWBs with the interactive features will attract students' attention and increase concentration. In the meantime, IWBs strengthen students' motivation in learning (Marzano, 2009; Schmid, 2008; Smith et al., 2005). The teachers' attitudes and technological skills effects motivation significantly.(Glover et al., 2007; Holmes, 2009; Torff & Tirotta, 2010).

Harper, Chen and Yen (2004) observed that pedagogy, technical, attitude and curriculum issues are main concerns for developing advisers' ICT teaching skills. In recent years, the IWB is a relatively new ICT tool introduced into classrooms. Researchers had found that many benefits of using them to develop into enhancing students learning experiences in the future (Smith , 2005). Holmes (2009) further indicates that providing proper training is the best

significant way to help teachers to successfully use IWBs in their classrooms. In the beginning, training is usually offered by enterprises or IWB suppliers, which is not enough for most beginner adopters (Smith, 2005).

The chosen schools applied IWB in teaching exposition sites. Each school selected one or two topics, such as Natural Science, English, Mathematics or Music, to plan and arrange IWB lessons and activities. To make better use of IWBs, teachers from different subjects worked together in classrooms for formative strategies and creating materials suitable for interactive whiteboards. The pilot platform of IWB has received definite outcomes, in accordance with teachers' responses and published articles from the Ministry of Education.

The central government moreover announced a national project in 2009 called "Creating equal digital education environment in elementary and secondary schools". The purpose of this plan is to build more than 6,500 e-classrooms with IWBs and overhead projectors in all secondary and elementary schools (Taiwan Ministry of Education, 2009). IWBs have become new ICT tools adopted into classrooms for many schools. Therefore, the government has arranged a series of trainings to help teachers to get conversanted with this new technology. However, the successful use of IWB in classrooms relies on the teachers' viewpoints about IWBs. In recent years, many theses has been written in different subject areas about the use of IWBs in schools (Schmid, 2008; Kennewell et al., 2008; Zevenbergen & Lerman, 2008; Quashie, 2009; Troff & Tirotta, 2010), and pedagogic benefits and disadvantages of this new tool (Glover et al., 2005; Smith , 2005; Slay , 2008), but little theses and papers is available focusing on teachers' acceptance particular.

2. Research model and hypotheses

The British Educational Communications and Technology Agency (BECTA) had made a definition of what IWBs is (BECTA 2003b, p. 1):

An interactive whiteboard (IWB) is a touch-sensitive board, linked to a computer and a digital projector. The computer can be commanded by touching the board, directly also with a particular pen. The projector can then show images from the computer on the board. The operation mode of IWBs is shown as Fig. 1. Among the possible applications are (Lin 2010) :

- using web-based teaching materials in whole-class teaching
- playing video clips to help students understanding concepts
- displaying a piece of software
- presenting students'work to others in the classroom
- creating digital flipcharts
- manipulating text and practicing handwriting
- saving notes recorded on the board in the cause of future use
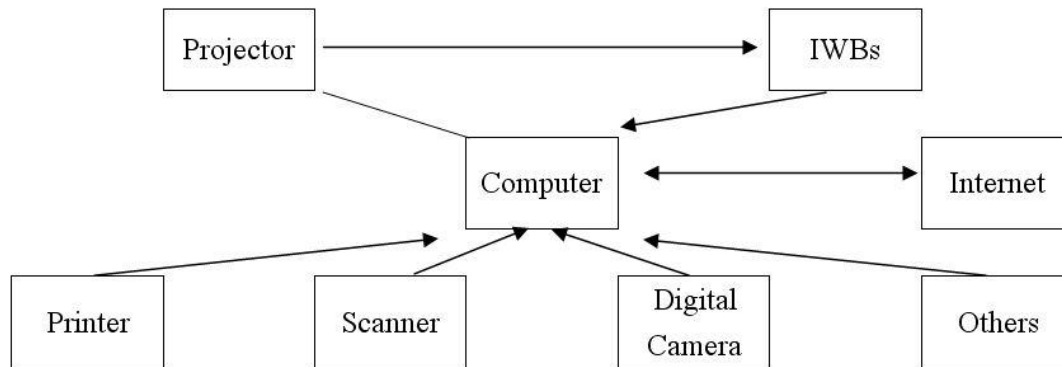- quick and seamless revision.

Fig.1. What is an IWB

3. Expectation Confirmation Theory

Expectations-confirmation theory (ECM) assumes that expectancies, together with perceived performance, result in post-purchase satisfaction. This outcome is intervened through positive or negative confirmation between performance and expectations. If a manufacture towers expectations will result in post-purchase satisfaction. If a manufacture falls without expectations the consumer is probably to be dissatisfied (Oliver, 1980; Spreng, 1996). The Model of ECM theory is shown as Fig. 2.

The four main conceptual elements in the model are: performance, expectations, disconfirmation, and satisfaction. Expectations send back anticipated behavior (Churchill and Suprenant, 1982). They are predictive, pointing out expected product features at some point sometime (Spreng, 1996). Expectations are used for the comparison criterion in ECT – what purchasers use to estimate performance and develop a disconfirmation judgment (Halstead, 1999). Disconfirmation is generalized to affect satisfaction, with negative disconfirmation leading to dissatisfaction and positive disconfirmation leading to satisfaction.

A major argument within the marketing literature affects the nature of the consequence of disconfirmation on satisfaction. The basic cause of the problem consists in the determination when perceiving performance we take the comparison standard of predictive expectations. In this condition, the negative expectation of confirmation is not possible to lead to satisfaction (Santos and Boote 2003). To overcome this problem, research fellows have proposed other comparison criterions such as ideals, equity, desires, or past product and brand label experience (see reviews by Halstead, 1999; Yi 1990 and analysis by Tse and Wilton, 1988. Also see Spreng, 1996; Woodruff, 1983). We got the result of hypotheses from ECM:

H1. Users' confirmation with IWB is positively related to their satisfaction.

H2. Users' satisfaction with IWB is positively related to their intentious to use.
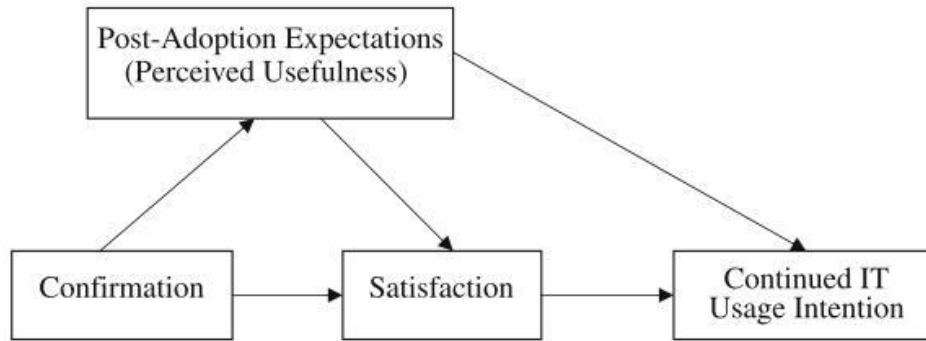
Fig.2. Expectation Confirmation Model

4 Technology Acceptance Theory

In order to understand technology acceptance, the Technology Acceptance Model (TAM) is the most widely accepted theoretical framework in recent years. Introduced by Davis (1989), TAM has being adapted of the ''Theory of Reasoned Action'' (Ajzen & Fishbein, 1980) particularly adapted for modeling users' acceptance of technologies. The intention of TAM is to give an explanation of the occasions of computer acceptance. Perceived ease of use and perceived usefulness are hypothesized to be the essential occasions of user acceptance (Davis, 1989). The simplified TAM was also throughout proved the validity empirically (Venkatesh, 1999; Venkatesh & Davis, 1996, 2000).

Gressard and Loyd (1985) pointed out that the perceived usefulness of technologies can affect attitudes towards technologies and the more positive a teacher possesses in using technologies, the more instruments she or he has in the classroom. Yuen and Ma (2002) indicated that the two unconnected variables 'perceived ease of use' and 'perceived usefulness' affect the intention to technology use as declared in the TAM forthrightly. However, Legris, Ingham and Collerette (2002) assumed that ''TAM is a profitable model, but has to be associated with a extensively one which would involve variables connected to both social and human change processes and to the option of the novelty model''. Consequently, while TAM acted as the main framework in this research, suitable social and human manufactures have also been explored to provide a better understanding to the study of interactive whiteboard technology acceptance through teachers.

After review highly relative literature, it shows that ''computer self-capacity'' of teachers and ''mental norm'' of the teachers' workplace are proper constructs to be considered in characterizing the synthesized framework (e.g. Compeau & Higgins, 1995, 1999; Taylor & Todd, 1995; Venkatesh & Davis, 1996; Venkatesh, Morris et al., 2003; Hall & Higgins, 2005; Ma , 2005).

The Theory of Reasoned Action is established on the hypothesis that human are usually sensible and make methodical use of information obtainable to them. Because most actions of social reference are under voluntary control, the theory observed an individual's purpose to execute (or not to execute) a behavior as the immediate decisive factor of the performance. It suggests that an individual would commonly act in a manner conforming with his or her purpose and intention. An individual's purpose and intention is a function of two basic occasions, the social influence individual and one individual in nature. This occasion was

termed subjective regulation as it deals with recognized prescriptions. The second determinant of purpose was individual factor is the individual individual's positive or negative appreciation of executing the behavior. This factor is termed position toward the behavior which is attributed to the individual's discretion that performing the behavior. Individual percipience behavior.

Generally speaking, individuals would planed to perform a behavior when they criticize it positively and when they suppose that significant others thought they should execute it (Ajzen & Fishbein, 1980). Fig. 3 presents the TAM.

Social cognitive theory (Compeau & Higgin, 1995; Compeau et al., 1999) comes up with the thought of self-efficacy, delineated as the faiths about one's capacity to perform a particular behavior. In the view about our expectancies of positive results of a behavior would be insignificant if we felt uncertain about our capability to well execute the behavior in the beginning. The theory constructed on the faiths that ability to use technology well is related to the determinations about how much and whether to deploy technology and the amount to which an individual is able to study from training. Furthermore, social cognitive theory aboveboard acknowledges the existing of a uninterrupted reciprocal interaction between the surroundings in which an individual operates his or her mental understandings percipience (self-efficacy and result expectations) and behavior (Bandura, 1986). Thus, self-efficacy is regarded in social cognitive theory with an harbinger to use, but successful to interact with technology are also regarded as influences upon self-efficacy. Therefore, we posit that:

H3. Users' perceived ease of use with IWB is positively related to their attitude.

H4. Users' attitude with IWB is positively related to their intentious to use.
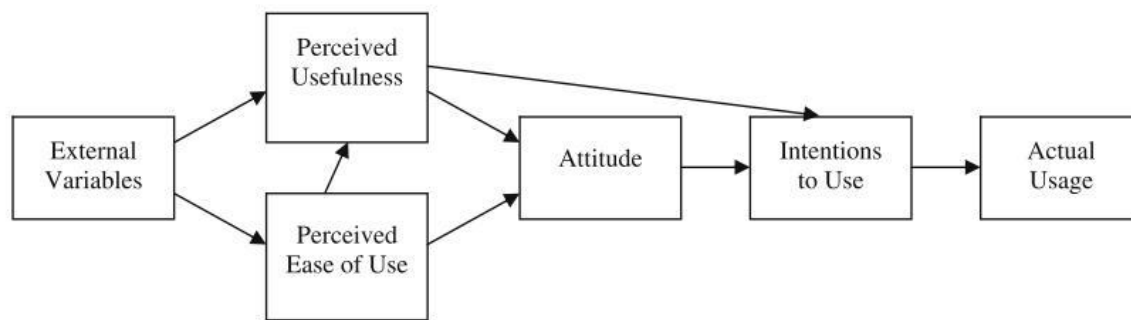

Fig.3. Technology Acceptance Model

5 Flow Theory

Trevino and Webster (1992) defined flow as the linear conjunction of four features: control, attention, curiosity, and intrinsic interest. Csikszentmihalyi & Csikszentmihalyi (1988) focusing upon the compatibility of a person's skills in a special behavior, and their perceptions of the dares in the behavior. The person's criticism of the skills and dares is typically thought of comparative to other activities that the person performs, instead of on absolute degrees.

In Hoffman and Novak (1996), they define flow in the light of the experience of flow (loss of self-consciousness, intrinsic enjoyment), organic properties of the flow action (seamless sequence of replication accelerated by interactivity with the self and computer -

reinforcement), and forerunners of flow (focused attention, telepresence, and skill/challenge balance).

Flow is a complicated concept, and researchers measure Flow through multiple dimensions frequently. Ghani, Supnick (1991) measured flow by using two constructs: concentration and enjoyment. Huang (2003) address flow contained four constructs , namely: attention focus, control , intrinsic interest, and curiosity. What is more, Li and Browne (2006) defined that flow experience had four aspects: control, focusedattention, temporal dissociation and curiosity. Finally, Koufaris (2002) developed that flow experience has three aspects to measure, including concentration, perceived control, and per-ceived enjoyment. The Model of Flow theory is shown as Fig. 4. We got the result of hypotheses from Flow theory:

H5. Users' perceived enjoyment with IWB is positively related to their attitude.
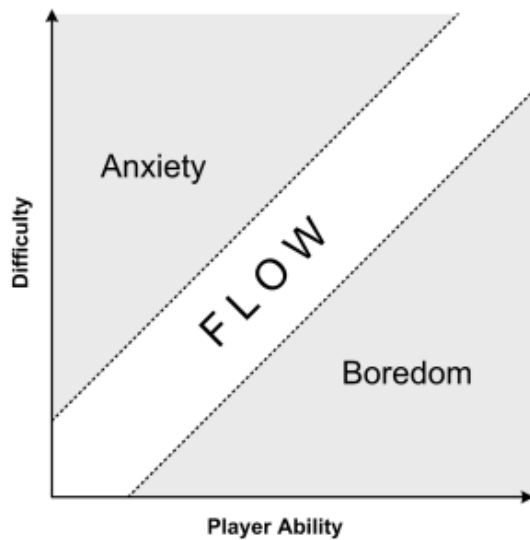

Fig.4. Flow Theory

6. Discussion and Summary

This research applied three theories including Technology Acceptance Model (TAM), Expectations-confirmation theory (ECM) and Flow theory. The aim is to figure out teachers' acceptance to IWBs. While using this model, confirmation, perceived ease of use and perceived enjoyment were introduced into form a combined model to explore teachers acceptance of interactive whiteboards. The direct and indirect results of each construct organized the theories and were examineed through empirical data. Fig.5 presents our research model and hypotheses. The variable operational definitions are shown in Table 1.
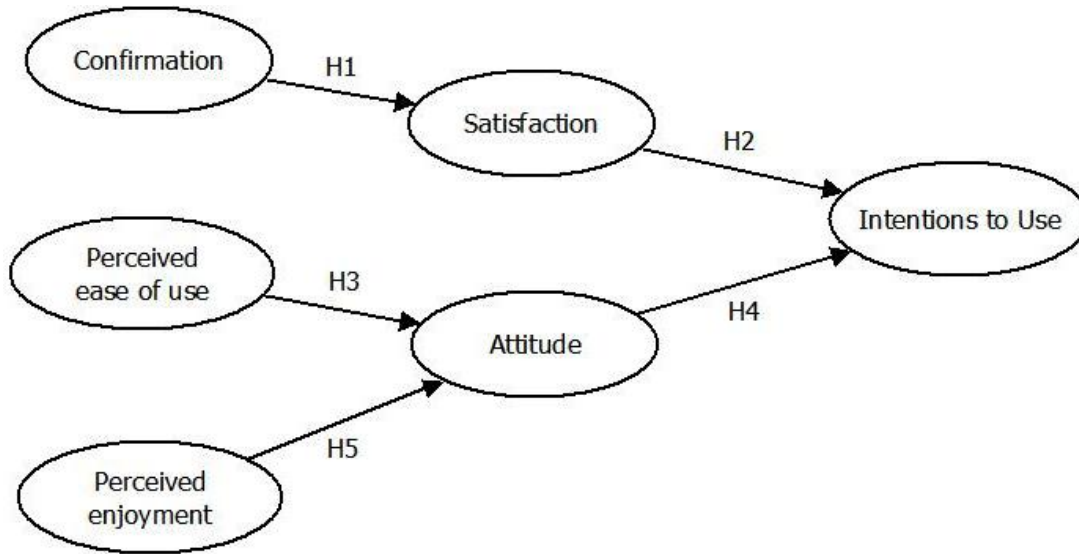
Fig.5. Model framework and hypotheses development

Table 1. Variable operational definition.

Variable	Operational definition
Confirmation	Confirmation is defined as users acquired expected advantages when they use with the IT through the usage experiences.
Perceived ease of use	Perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis 1989, p. 320).
Perceived enjoyment	Perceived enjoyment is defined as "the extent to which the activity of using a specific system is perceived to be enjoyable in it's own right, aside from any performance consequences resulting from system use" (Venkatesh, 2000).
Satisfaction	Satisfaction is defined as 'the summary psychological state resulting when the emotion surrounding disconfirmed expectations is coupled with the consumer's prior feelings about the consumption experience' (Oliver 1980, p. 29).
Attitude	Attitude refers to ''the degree of a person's favorable or unfavorable evaluation or appraisal of the behavior in question'' (Fishbein & Ajzen, 1975).
Intentious to use	Intentious to use refers to the individual's interest in using the system for future work.

Because of the digitalization difference between suburbs and cities as well as different areas, the result of this research fits only to those counties with similar geological, economic and environmental background.

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