The Influence on Behaviors of Teachers Using the Interactive Electronic Whiteboard for Teaching at Primary Schools

Yi-Fang Chen[1]

Doctoral Candidate / Institute of Education
National Sun Yat-sen University,
Kaohsiung, Taiwan
yifangmeister@gmail.com

Horng-Jyh Chen[2]

Professor/Management Information
Kao-Yuan University
Kaohsiung, Taiwan
hj168.chen@msa.hinet.net

Abstract: *In recent years, the Ministry of Education in Taiwan promoting e-classroom primary schools have also contributed to the purchase of interactive electronic whiteboards for teaching. However, compared to the traditional blackboard teaching the researchers tried to explore the issues whether whiteboard can enhance the effectiveness of learning and whether teachers using whiteboards will cause inconvenience of teaching which led to decline in the effectiveness of learning. Therefore, this study by using UTAUT model for the foundation hopes to explore the status of teachers in the whiteboard teaching and whether it has a positive impact on their intension to use. According to the analysis results of SEM-PLS, this study discusses patterns for the whole meaning of the practice and further proposes for advice on teaching practice and also through the results in order to improve the overall intension to use whiteboards for teaching.*

Keywords: *E-classroom, Interactive whiteboard, UTAUT model, SEM-PLS analysis, Intension to use*

1. INTRODUCTION

Taiwan government in recent years to promote information and communications technology (ICT) into the education policy is quite positive. The Ministry of Education in the "construction of demonstration schools to promote e-learning environment plan" at some primary schools build subsidy "e-classroom". The whiteboards, single gun projectors, computers and other related equipment are imported for classroom teaching and interactive whiteboard (IWB) teaching experiment. Of course, e-classroom teaching activities for the current hot topics information technology into the teaching subjects is focused on the development of education in this field that can " to make learning of diversified pipeline, broader and rich learning resources increases the depth and breadth of learning to enhance the interest in learning and to meet the need for students to self-learning "[1].

Compared to the traditional blackboard, interactive whiteboard is a more functional presentation of the display tools and learning platform because of its highly interactive nature of the character that is one of the advanced technical aids being applied to classroom teaching. Teachers can more effectively demonstrate the learning content and learning process of recording relevant information while learners in the learning process will have more participatory and interactive opportunities. Interactive whiteboard using in teaching is increasingly common in the United Kingdom, the United States and Europe especially in the British government focus most. The London region in the middle school classroom interactive whiteboard installation rate has reached 97%, with interactive whiteboards in primary school has reached 70%. [2] The popularity of electronic whiteboard is also increasing more and more.

Of course, the social psychology behavioral science theory is most commonly used to interpret the user's attitude and behavior. In addition to other issues research user behavior in information management is a very important issue. [3]. Many studies discussed on "why do people use Blog" [4] "the use of value-added services operations" [5] "the factors of Facebook continued use" [6] "to understand the social networking site's behavioral intentions" [7] and so on. Of course, in the past in the field of information management researchers explore user behavior studies that used most deliberative Theory of Reasoned Action (TRA), Theory of planned behavior (TPB) and the Technology Acceptance Model (TAM) and investigate user behavior as a theoretical basis. Its

purpose is to identify the most important factors that influence on user behavior. The current theory of deliberative action, theory of planned behavior and technology acceptance model in the field of information management and behavioral science has gained considerable attention and support.[8],[9].

However, to research in behavioral intension the basic assumption is that the deliberative theory of action is based on a person's behavior under the control of self-will and is a rational behavior [10]. In view of technology acceptance model, students use technology depends on the attitude of the user's own belief. Their beliefs including perceived usefulness and perceived ease of use explain or predict the intention of using of information technology [11], [12], but the Theory of planned behavior noted that human behavior is rational and regarded as plans of users behavior is often not just influenced attitudes and subjective norms that must also consider the individual's intension to control [13]. Of course, the Theory of planned behavior differs from the behavior of deliberative action theory is that the intent of the perceived behavioral control on multiple factors or constructs. But regardless of Theory of planned behavior and deliberative action theory technology acceptance model is still only a single factor from the measure. The whiteboard intended use not only explores the technology or perception-oriented but also considers a number of different level factors.

In addition, the integrated technology acceptance model (Unified Theory of Acceptance & Use of Technology, UTAUT) combined many different technologies to integrate the use of behavioral theory of new theoretical pattern [14] which combines the new technology import problems related theory. The impact of technology intended use performance expectations, efforts expectations, social impact and the impact of technology usage behavior are facilities intended use and technological factors.

In summary, this study will use UTAUT model to discuss behavior status of teachers using interactive whiteboards in teaching. This study will be at the core of teachers at primary schools in Taiwan to explore behavioral intention of teachers for the use of interactive white boards in teaching to gain insight into the impact factor, business and academia to provide recommendations on the future of the practical application of the research.

2. LITERATURE REVIEW

2.1. Interactive Whiteboard

Interactive whiteboard can be used to improve the teaching and learning environment and increased the effectiveness of teaching. It has a dual function of the board and computer screen which can connect via USB to the computer and use a single gun projector projected on the whiteboard and with e-books textbooks software through directly touch the screen to replace the mouse function in front of the main advantages of operating a computer classroom for teachers and students with interactive teaching [15].

In addition to interactive whiteboards it combines computers, projectors, scanners, speakers and network. The more teachers can also connect digital cameras, video cameras, electronic microscope, IRS instant feedback system and other ancillary products. The visual field of teaching or curriculum needs purchase with the integration of the various equipments coming from the classroom. The teachers led innovative teaching methods of teaching to the use of diverse hardware and software. Those provide a more gradual concept learning that students and teachers improve fun of teaching and learning. [16].

2.2. Unified Theory of Acceptance and Use of Technology

By the research in science and technology acceptance, the reason why the introduction of new information technology has been an important research topic. In recent years, many scholars have conducted research on different areas to suggest for intended use and behavior of external variables are also increasing. Past empirical research indicates that these patterns for personal intentions to use and behavior are more than 40 percent of explanatory power [14].

Venkatesh [14] decided to re-examine, compare and integrate the factors of each mode, the proposed technology acceptance and use the integrated model. In order to make a more effective model to assess and explain the factors that users adopt new technologies. UTAUT believes that the personal for the reaction of IT usage will affect the intended use. Intended use will affect the actual behavior.

UTAUT will integrate past literature into four main factors: Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Condition, and four control variables: Gender, Age, Experience and Voluntariness of Use and to the evidence, it is found that the use of UTAUT can explain behaviors up to 70% [14].

3. RESEARCH METHODOLOGY

In this study, using technology acceptance and integration model for its theoretical basis explores the performance expectations and effort expectations whether social influence, facility conditions affect teachers' intensions to use and behavior. The overall model is shown in Fig.1.
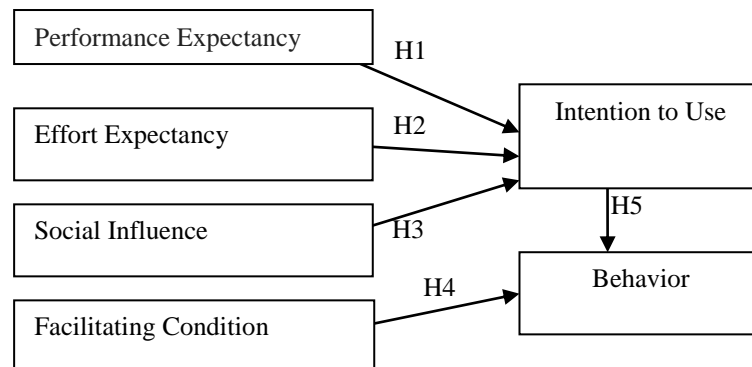

Fig1. *Model of research*

Venkatesh [14] proposed that the use of technology acceptance and integration model considers performance expectations, effort expectations, and social impacts of the efforts will affect its intended use. On the other hand, intended use and the facilities will also affect the user's behavior. Therefore, an overview of technology acceptance and use the integrated model of the original argument this study proposes the following hypothesis:

H1: On the use of the interactive whiteboard performance expectations of teachers will positively affect the intended use.

H2: The effort expectations will positively affect the intended use of the use of interactive whiteboards.

H3: The social impact of teachers on the use of the interactive whiteboard will positively affect the intended use.

H4: On the use of interactive whiteboards contributing factors of teachers will positively affect the actual use.

H5: On the use of interactive whiteboards intended use of teachers will positively affect the actual use.

3.1. Operational Definitions

According to research pattern, the operational definitions of this research are in the following Table1:

Table1. *Operational definitions*

Factor	Operational definition	Reference
Performance Expectancy	Teachers believe that the use of interactive whiteboards can promote or enhance the quality and extent of teaching effectiveness	[14]
Effort Expectancy	Teachers think that the use of interactive whiteboards easily	[14]
Social Influence	Teachers think that most people affected by the surroundings and then use the interactive whiteboard in teaching	[14]
Facilitating Condition	Teachers think that the school (including equipment, software) existing equipment and technology will support systems	[14]
Intension to use	Defined as teachers are willing to use the interactive whiteboards or would recommend others to use.	[10]
Behavior	Is defined as the actual use of time and frequency to measure	[13]

3.2. Instrument Developments

In this study it had experience of teachers using interactive whiteboard at primary schools of northern Kaohsiung in Taiwan and used questionnaires to collect information that refer to the relevant information according to the research purpose and research pattern. It prepared a seven-point Likert scale of the questionnaire as a research tool. The questionnaire divided into six major factors: performance expectations, efforts expectations, social impact, facilities conditions, intended use for basic personal information. After pre-test reliability and validity analysis, it deleted some factor loadings below 0.6 of two questions. The school system selected sample teachers at regular intervals and random samples had been taken. Official questionnaires were distributed and 300 were returned of 255 copies. The recovery efficiency is of 85% formal questionnaire items and the reliability and validity of the analysis are up to a good standard.

4. ANALYSIS AND RESULTS

4.1. Data Collections

According to the results of analysis of the samples of the research questionnaire, the impact of the use of interactive whiteboards for teachers intended to use for teaching. The average for each question ranged from 5.003-5.707 for various factors. It included the highest average number of "facilities", followed by "intension to use", "performance expectations "and" effort expectations ". Basic information is as follows:

1. Gender: The valid questionnaires, males accounted for 40.2% of effective sample size, females accounted for 59.8% of the effective number of samples. The numbers of valid samples are with females mostly. And more female teachers are teaching at primary schools in gender also.

2. Age: The valid questionnaires to a maximum of 50.5% from 36 to 45 years old followed by 28.7% from 26 to 35 years old, the third of 46 to 55 years old 16.9%, 3.5% under 25 years old, 56 years of age at least 0.4%.

3. The duration of study: The valid questionnaires, while teachers' participation in the relevant study with using whiteboard number from 0 to 6 hours to a maximum of 62.2%, followed by 24.4% from 7 to 18 hours, and the third of 19 to 30 hours 8.7% more than 31 hours at least 4.7%.

4. The use of time: valid questionnaires in this study, according to teachers' experience to use within six months to a maximum of 55.5%, followed by six months to a year of 28.7%, the third of 13.0% from one year to two years, more than two years at least 2.8 %.

5. Frequency of use: The teacher of this study in order to know the frequency of the use of the whiteboard but is rarely used for a maximum of 48.4%, followed by 22.0% few times a week, and the third used few times per month 12.6% and use 9.1% a day and also every class uses the least 7.9%.

6. Fields of teaching: In this study, the effective questionnaires, 50.6% of teachers will use the whiteboard in the field of language teaching, 42.2% of the teachers will be used in the field of mathematics education, 32.1 percent of the teachers will use in teaching natural and biotechnology field, 26.5 percent of the teachers will use in teaching the social, 12.5% of teachers will use in teaching the arts and humanities, 8.4% of the teachers will be used in the field of health and physical education and 13.3 percent of the teachers will use in integrated activities in the field of teaching .

7. Voluntary: Teachers of this study using the whiteboard voluntary, voluntary up to 36.6%, followed by 22.4 percent somewhat voluntary, third as much voluntary 21.7 percent, 10.2 percent have no opinion, somewhat involuntary 6.7%, not voluntary 2%, is not voluntary at least 0.

4.2. Reliability and Validity of Measurements

A confirmatory factor analysis was performed to examine the measurement model. The partial least squares (PLS) method using Smart PLS 3.0 was chosen because it presumes no distributional form for measured variables, nor does it posit a strong requirement for large sample sizes [17], [18]. PLS supports both exploratory and confirmatory research [8] and gives optimal prediction accuracy because it is prediction-oriented [19].

Internal consistency can be assured by examining the composite reliability of the factors or constructs [19]. In this study, all composite reliability values were greater than 0.7 [19]. Convergent validity

refers to the degree to which multiple items measure one factor or construct. Convergent validity can be evaluated by checking whether (1) the average variance extracted (AVE) values are larger than 0.5 [19], and (2) the factor loadings of the all items are significant and higher than 0.6 [20]. Overall, all these conditions were met, indicating acceptable convergent validity of the measurement.

Finally, discriminant validity requires whether the measures of factors or constructs are different from each other. Discriminant validity can be assessed by examining whether the square root of AVE of each construct is larger than the correlation between constructs [17], [20]. According to the results, the square root of AVE value in the diagonal for each factor or construct was larger than the correlation coefficients in the corresponding rows and columns, thus, discriminant validity was confirmed. In summary, the measurement model of this study demonstrated adequate reliability, convergent validity, and discriminant validity.

4.3. Common Variance Bias

This research took both procedural and statistical remedies to mitigate possible common method biases. First, Tourangeau et al. [23] suggestions were adopted to develop the questionnaire items to reduce method biases. The expert review and IS professor described earlier also served to assist this purpose. Reminding respondents to answer questions as honestly as possible would also help reducing common method biases. [22]. The online questionnaire, though being short, was also specially designed to include multiple pages to temporally separate the measurement of all research factors or constructs [21], [22]. Second, the statistical remedy, the Harmon's single-factor test displays that each principal factor explains roughly equal variance, indicating no substantial common method bias problems.

4.4. Structural Model and Results

To test our hypotheses dealing with the effect of teacher's intention to use on the model, bootstrap re-sampling procedure was used to examine the stability of the PLS estimates[17], using re-samples of 300. In this research, moderating effects can be assured by comparing the difference between the interacting effect and the main effect models [18]. The model test for the all respondents is shown as Fig 2.

Overall, the research model is supported and explains 31.0 percent of the variance in intention to use interactive electronic whiteboard. The path coefficients performance expectancy (H1) to intention to use were found to be positive and insignificant, with coefficients of 0.1 (t-value=1.327). Second, Effort Expectancy (H2, β=0.45, t=4.522) had significantly effect on intention to use. Third, the effect of social influence on intention to use (H3, β=0.47, t=5.222) was significant at the p< 0.05 level. Fourth, facilitating condition (H4, β=0.17, t=2.221) had significantly effect on behavior. Finally, the effect of intention to use on behavior (H5, β=0.44, t=5.045) was significant at the p<0.05 level.

P-value <0.05 *
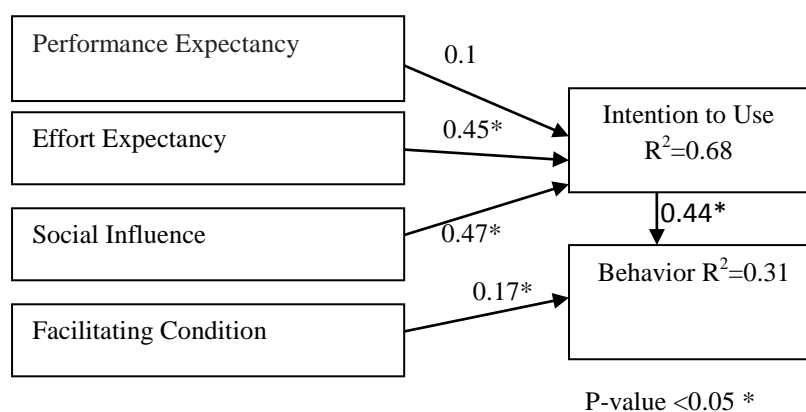
Fig2. *Results of research*

5. DISCUSSIONS AND CONCLUSIONS

First, for many teachers, changing the strategy of teaching is a new challenge. How to make teachers at primary schools intend to confront and the use of IT equipment or the use of digital technology and the way of teaching is an important issue. It is proposed "Education Development Center" under the

current research, the establishment of the Research Center for educational digital technology and whiteboard promote group discussion of teachers. In the use of the resolve to help enhance information literacy competency of staff, equipment, teachers use planning, establishment and other teachers to share internet community effectively enhance the usability and useful cognitive interactive whiteboards and other technology information digital teaching.

Secondly, the teachers give timely high quality and high performance learning training will effectively enhance the interactive whiteboard to promote success. Educational authorities should understand user needs. In conjunction with relevant background professors and experts, systematic planned interactive whiteboard training courses, training and recruiting talented teachers seed, consisting of group counseling to help schools handle interactive whiteboard systematic curriculum training, information literacy will enhance teachers' ability to use the interactive whiteboard.

Of course, it can be learned through this study. Teachers in the perception of the usefulness of an interactive whiteboard and ease of use are higher for using of interactive whiteboards for the behavior of the higher intension. Therefore, requiring manufacturers or software designers design interactive whiteboard strengthen the usefulness and ease of use, with user-friendly interface design, taking into consideration the needs and abilities of teachers will help to enhance the acceptance of the interactive whiteboard.

Finally, in the implementation of an interactive whiteboard at primary schools in Taiwan, the proper planning should be finished by professional teams that establish a system to gather regularly to do meetings and create a learning environment and active team atmosphere so that teachers can fully discuss the curriculum and mutual support cooperation to improve teaching problems to play the effectiveness of teaching.

Looking at the above conclusion, the present study with its limitations is as follows:

1. In this study, using whiteboards for teaching at primary schools is as study materials but it only covers research in Taiwan with inadequacies for different countries in the research and analysis.

2. In this study, UTAUT is the only way to verify data analysis. Different model comparisons if possible, further exploration will make more contribution to the results of this study.

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AUTHORS' BIOGRAPHY

Yi-Fang Chen

Doctoral Candidate / Institute of Education

National Sun Yat-sen University

Kaohsiung, Taiwan

yifangmeister@gmail.com

Horng-Jyh Chen

Corresponding Author

Professor/Management Information

Kao-Yuan University

Kaohsiung, Taiwan

hj168.chen@msa.hinet.net