The Impact of Different Teaching Models on Learning Interest and Comprehension Based on Interactive Electron White Board

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Abstract. Interactive whiteboard (IWB) technology has the capacity of combining teaching resources and serving as a platform of teacher–student interactive learning. Schools which use IWBs in their teaching, experience changes in the classroom teaching environment that directly influences teacher–student interaction and indirectly influences the intension. This research proposed an environmental structure based on information communication and technology for teaching that used IWB technology, whereby the IWB and client-server were regarded as central to combine educational resources, a network and virtual IWB technology. Use of IWB technology improved the level of interest students took in their studies and increased student participation. In addition, teachers efficiently achieved their teaching goals.

Keywords: Information Communication Technology, ICT ; Interactive White Board, IWB ; Learning participation

1. Introduction

Teachers have a duty to provide students with a learning environment that is as close to ideal as practicable and create a conductive atmosphere in order to maximize students' learning. With progress in technology and the advent of new teaching aids, the key research interests have stemmed from how to effectively integrate information technology into learning, how to effectively manipulate the different teaching styles the facilitate the transition from traditional unidirectional learning into interactive learning and understanding the impact of using these teaching styles on learning.

Interactive whiteboards (IWB) have gradually become commonplace in classrooms in the UK, the US and other developed countries. Since 2007, Taiwan, the Republic of China, according to the Ministry of Education's plan for *establishing an e-learning environment*, has subsidized the implementation of IWB classrooms across various city and county areas.

2. Literature Review

2.1. Change Process for Teachers and Students

Beauchamp (2004) in his study on the process of a primary school applying IWB technology, has utilized classroom observations and semi-open (infrastructure) style interviews to propose a five-stage framework. This framework was used to describe the change process when teachers and students used IWB.

(1) Black/Whiteboard Substitute: IWB was only operated by the teacher and in teaching; IWB was mainly used for writings, drawings and application initialization.

(2) Apprentice User: In this stage, the majority of teachers used custom-made teaching files and in the teaching process, used files were stored for future reference or teaching validation.

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(3) Intermediate User: In this stage, teachers were becoming familiar with IWB operations and were using a greater variety of programs. As such, these teachers incorporated more effects and media into their teaching material. These included a wide use of images, sound files and other external sources such as websites.

(4) Advanced User: In this stage, teachers scanned images for use in the whole class from a range of sources including teaching activities, students' work, textbook contents, worksheets, etc.

(5) Synergistic User: In this stage, both teachers and students demonstrated high-level abilities in using an IWB.

2.2. Electronic Interactive Whiteboards

Electronic interactive whiteboards could directly execute various computer operations to increase the effectiveness of learning and teaching. There were three categories of electronic whiteboard application features (A.M.Eskicioglu & D.Kopec, 2003):

1. Copy boards,

2. Peripheral boards, and

3. Interactive whiteboards.

2.3. Information Communication Technology (ICT) Learning and Teaching Environment Setup

In the setup of an IWB-based ICT learning and teaching environment, Newhouse (2006) noted that it was necessary to consider the role and behavior of the teacher/student and according to the change process described above, the researchers could generally understand the interaction content between students and teachers as well as the development process when IWB was used in teaching activities. The following key points needed to be noted in the setup of an IWB-based ICT learning and teaching environment:

(1) IWB software/hardware setup and use: Kennewell and Morgan (2003) suggested that the height of IWB be reduced to facilitate its use for younger students or students that are shorter. It was necessary for the teacher to allow students the opportunity to use and practice IWB in learning, as proposed by various scholars (Beauchamp, 2004; Goodison, 2002; Kennewell & Morgan, 2003; Morgan & Kennewell, 2006).

(2) Integration of teaching resources: when teachers have become experienced in IWB operations and applications, significant amounts of multimedia material were subsequently used. In particular, as ICT was increasingly applied in teaching and learning activities, large amounts of teaching resources including teaching materials, websites, student work, teaching software, etc. (Goodison, 2002).

(3) Developing ICT abilities: due to a teacher's existing experience with blackboards, he/she typically viewed IWB as a non-digital whiteboard at first use. If there were no ongoing professional learning and growth in IWB use, the IWB slowly became only as useful as a large screen display (Newhouse, 2006).

(4) Interactive teaching mechanism: Newhouse (2006) noted that the main use of IWB was for teachers to display information to the whole class. In the interactive teaching mechanism, the key goal was a beneficial relationship between the teacher, student and the technology used. This should allow teaching activities to be successfully created in the classrooms with a desirable effect.

2.4. Interactive teaching mechanism

In the traditional classroom, all teaching interactions are face-to-face. The introduction of ICT into the classroom has affected the type and model of teaching interaction. Newhouse (2006) classified the application of technology on teaching interaction design into the following three models, as shown in Figure 2-1:

(1) Whole Class: The teacher used technology in the teaching activities for the whole class, for e.g. course explanation, teaching demonstration and class discussion.

(2) One to One: The teacher let the student use technology to conduct individual teaching and learning activities, for example: computer-assisted teaching, revisions and individual learning.

(3) Group Work: The teacher let students form groups to conduct teaching activities using technology, for example: group presentation, group competitions and cooperative learning.
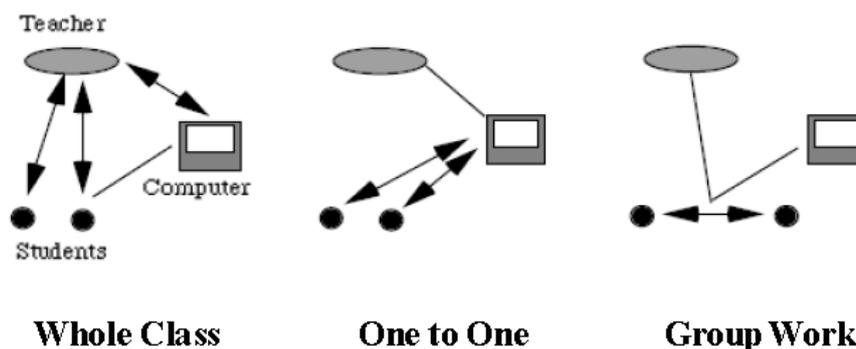

Figure 2-1 Application of technology in teaching interaction design models (Lines with arrows indicate main teaching interaction whereas fine lines indicate support teaching interaction)

3. Research Method

3.1. Research Structure

The organizational structure of this research was shown in the figure below, summarizing the information described above.
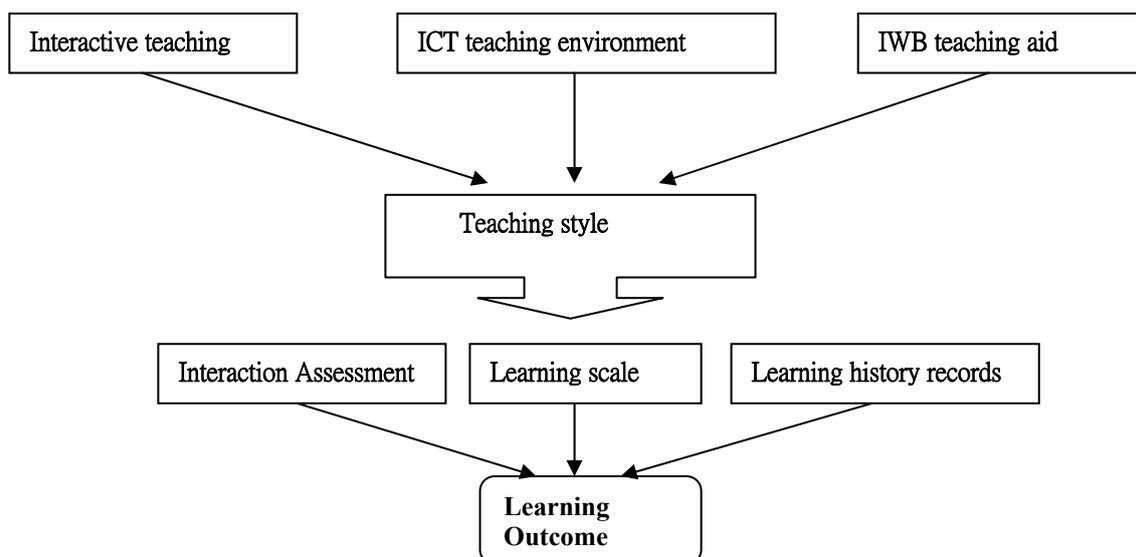

Figure 3-1 Research Structure

3.2. Research Sample

This study used sixth-grade elementary students from a school in Taichung, Taiwan, as the research target. A random sample of 65 students was taken from two sixth-grade classes and the quasi-experimental methodology was used to divide the sample into two groups, namely the traditional teaching group (32 students) and the IWB-aided teaching group (33 students). An experimental study with respect to mathematics teaching was conducted with these groups.

3.3. Research Tool

The research tools used in this study include the learning interest scale and the learning comprehension scale. They were used in teaching environments using an IWB-based ICT teaching system.

The questionnaire was custom-made, amended according to known questionnaires and was based on a Likert 5-point scale (i.e. the higher the points obtained, the great the impact). After the preliminary tests, an item analysis eliminated topics whose maximum and minimum points (approximately 27% of people), reliability Cronbach coefficient $\alpha=.701$(the learning interest scale), reliability Cronbach coefficient $\alpha=.68$(the learning comprehension scale) and that each eigenvalue obtained through the factor analysis is greater than

4. Cronbach's α is one specific method of estimating the reliability of a measure. If a Cronbach's α value is greater than.7, it is considered to be acceptable (Hair, Black, Babin, Anderson, & Tatham, 2006). In this paper, the instrument was considered adequate for the collect of data.

The learning interest scale consisted of 6 questions which represent the enjoyment a person experiences/positive attitude towards Mathematics after exposure to Mathematics-related learning activities. The learning comprehension scale is a modified version of the motivation scale developed by Bransford & Johnson (1972). It consisted of 7 questions.

3.4. Procedure Implementation

In the mathematics teaching experiments, two groups were used: the traditional teaching group as the control group and the IWB-assisted teaching group as the experimental group. The experimental group used IWB technology to assist the teaching of mathematics in a computer classroom with an ICT teaching system setup; a large amount of teaching material including 3D graphics, charts, and multimedia material was provided by the application resource of the electronic interactive whiteboard. The teaching material also integrated a greater variety of special effects and multimedia including a wide range of picture, sound files and other external resources such as Internet websites, enabling researchers to cater the teaching material to students with different abilities.

4. Research Results

4.1. Impact of Different Teaching Models on Learning Interest

Table 4-1 showed the results obtained from applying ANOVA on the learning interest scale of the IWB teaching model and traditional teaching model.

- ANOVA RESULTS FOR LEARNING INTEREST OF DIFFERENT TEACHING MODELS

Information Source	Sum of Squares	Degree of Freedom	Mean Sum of Squares	F value	Significance level
Inter-group	106.824	2	53.421	7.288	.001**
Intra-group	1502.677	205	7.330		
Total	1609.519	207			

*p <.05   **p <.01

From Table 4-1, the researchers noted that the learning interest of students that were subjected to different teaching models differs significantly (F=7.288, $p<.05$). In particular, after applying the Scheffe comparison test, the researchers observed that the M value of IWB teaching group (M=19.91) is greater than the traditional group (M=18.15). This means that the IWB teaching model had a significant impact on learning interest.

4.2. Impact of Different Teaching Models on Learning Comprehension

Table 4-2 showed the results obtained from applying ANOVA on the learning comprehension scale of the IWB teaching model and traditional teaching model.

From Table 4-2, the researchers noted that the learning interest of students that were subject to different teaching models differed significantly (F=4.548, $p < .05$). In particular, after applying the Scheffe comparison test, the researchers observed that the M value of IWB teaching group (M=24.12) is greater than the traditional group (M=22.60). This means that the IWB teaching model had a significant impact on the learning comprehension.

TABLE 4-2   ANOVA RESULTS FOR LEARNING COMPREHENSION OF DIFFERENT TEACHING MODELS

Information Source	Sum of Squares	Degree of Freedom	Mean Sum of Squares	F value	Significance level

Inter-group	95.127	2	47.563	4.548	.012*
Intra-group	2143.931	205	10.458		
Total	2239.058	207			

* $p < .05$

5. Conclusions

This research has investigated the impact of using an IWB-based ICT teaching system for mathematics teaching on student learning, in which the teaching environment was an IWB-based ICT teaching system. Through an interactive control environment created by the computer and projector, the entire electronic whiteboard was equivalent to a large touch screen. It enabled real-time worksheet correction through teacher-student interaction where teachers guided students in real-time and clarify any misconceptions of the learning material. This in effect improved the students' learning effectiveness. The results obtained from the research showed that the two groups (i.e. traditional and IWB-aided) had different impacts on learning.

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