

# Innovative Improvised Low-Cost Wiimote Interactive Whiteboard (IW-IWB) Learning Tool For Teaching Chinese As A Second Language (TCSL)

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**Abstract:** *The aim of this study is to understand the effectiveness of Improvised Low-cost Wiimote Interactive Whiteboards (Iw-IWB) as educational technology learning tool for Teaching Chinese as Second Language (TCSL) for lower primary pupils in government schools in Malaysia settings. This study are to design and develop an improvised Wiimote IWBs and to identify how far the new innovation leaning tool, the improvised version of interactive whiteboards, could improve pupils' achievement and their learning motivation in learning Chinese as a Second Language (TCSL). A total number of 46 lower primary pupils study in government schools have involved in this study. The participants were split into two groups (treatment and control). The treatment group used the new developed improvised low-cost Wiimote interactive whiteboards (IWBs) to teach and learn Chinese characters, while the control group used traditional pedagogy. In this study, researchers have design and develop the improvised version of interactive whiteboard and thereafter using pre-test and post-test to identify the effectiveness of the new developed learning tool to enhanced pupils achievement and learning motivation in learning TCSL. The outcomes of the study showed that there has no difference in the students' achievement and level of motivation between the classes with and without the use of improvised low-cost Wiimote IWB. However, the students' achievement did show significant improvement before and after the use of Wiimote interactive whiteboard. Implication, improvised low-cost Wiimote IWB is a low-cost alternative which has potential to replace the expensive interactive whiteboard that many schools and teachers could not afford.*

**Keywords:** *Improvised Low-cost Wiimote IWB, Educational Technology, Chinese Language, Motivation.*

## I. INTRODUCTION

The developments of educational technology tools have radically changed the way in which humans communicate with one another and how they gain access to diverse information. The major impact of ICT is that it has now become an integral part of the peoples' lives. For example, in education, ICT is now one of the main components in the learning process that can help improve student learning.

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Apparently, the integration of ICT in learning has become an indispensable need, as evidenced by the pervasive adoptions of ICT applications or systems in blended learning in many schools and institutions of higher learning (IHLs). As anticipated, these learning institutions have begun adopting blended learning approach as one of the learning methods to meet the educational needs in producing knowledgeable and skilled students, who would be able to face new challenges in the 21st century.

Surely, such phenomenon introduces new challenges to Malaysia's educational system, entailing teachers to conduct quality teaching to help produce future generation of students who would be able to deal with new global challenges. The needs to produce quality students are underscored by the then Malaysia's Minister of Education, who (in his address of the Malaysia Education Blueprint 2013- 2025) said the following:

*"The government is committed to transforming the nation's educational system in the next 15 years. The main aim of the transformation is to equip every student in our nation with new, essential skills, with which they would be able to seize the opportunities offered by and face the challenges of the 21st century. In our efforts to compete with developed nations globally, our educational system must be able to produce new generation of students who possess sound knowledge, creative and critical thinking, strong leadership skill, and communication skill, which allow them to function effectively at the global level"* (Kementerian Pendidikan Malaysia, 2013, pp. )

To this end, MOE has planned and implemented a number of efforts to achieve the aims of educational transformation, such as changes in the curricula, reforms in the direction and methodology of the administration of the educational system, training of teachers, upgrading of ICT infrastructure in almost all schools, and smart schools initiative (Kementerian Pendidikan Malaysia, 2013).

## II. RESEARCH BACKGROUD

Many educators have incorporated technology as an instructional tool to raise student engagement [1-2]. As students' technological interests and skills change, creating an engaging environment became difficult [3]. Therefore, implementation



of IWB into the lesson is one of the ways to create an engaging learning environment in the classroom.

However, the commercial IWBs are too expensive [4-5]; Eriksson & Axelsson, 2014). Hence, many schools could not afford to have one, schools that provide one or more IWBs but they could not make it available in each of every classroom, especially Chinese primary school. A Chinese primary school in Malaysia is a national-type public school that is partially subsidised by the government. Therefore, certain utilities are sponsored by the Board of Directors and Parents and Teachers Association. Hence, some Chinese primary schools, particularly in rural areas, may not afford to have an expensive commercial interactive whiteboard. Therefore, teachers are not able to use them due to the unavailability. The cost of setting up an e-classroom setting is approximately USD\$2000, and above, about half of the cost is just to purchase an IWB.

Due to the above statement, a improvised low-cost Wiimote IWB has been developed to test the effectiveness of delivering tools for low primary pupils in the classrooms. Besides, the cost of the IWB, the impact of teaching Chinese characters using IWB on students has not been much research done so far [6]. Besides, the acceptance and effectiveness of low-cost Wiimote IWB in the context of pedagogy also has not been much research done too. Most previous studies and researches were using a commercial IWB in pedagogical practice in core subjects such as science and mathematics, English art, and many were involving preschool and higher institution participants. Furthermore, the study on the acceptance of IWB also has not been done much in the Malaysian schools' context. As IWB are proven to be effective in teaching [7-9], however it is unknown whether IWB is effective in teaching Chinese characters too.

Based on a survey done by the researcher, many Chinese primary school teachers in Malaysia are found rarely teaching using IWB in class too. This is because due to lack of facilities, and some are because teachers think it is inconvenient. They must turn on the computer and wait for the software to launched before use, thus wasting time. Meanwhile, chalk and blackboard can be use instantly, and usability is more familiar and comfortable. According to [10], the value of creative and improvised elements in the classroom is thus not managed well enough. Teachers' lack of knowledge of the features and potential of IWB and occasionally technical difficulties avoided them to deliver the lesson with the aid of IWB too [11].

However, based on the literature reviews related to the advantages of IWB in education, many contradictions in the findings. In Guðmundsdóttir's study (2014), findings show that the use of IWBs does not exhibit significant improvement in collaboration, communication, or interaction between students [10-11, 12]. [13-14] also found the use of IWB in the classroom is still a teacher-centred, whole-class approach teaching practice, just as the traditional pedagogy practice. Therefore, a study has to be done to determine whether there has significant difference between teaching and learning Chinese characters with IWB

and the traditional pedagogical teaching practice by using chalkboard.

### III. RESEARCH OBJECTIVES

The purposes of this research are to design and develop and investigate the effectiveness of innovative improvised low-cost wiimote IWBs for teaching and learning. The specific objectives of this research are listed as follow:

1. To design and develop improvised low-cost IWBs learning tools for Teaching Chinese as A Second Language.
2. To investigate the differences in students' achievement in between learning Chinese characters using improvised low-cost Wiimote Interactive Whiteboard and traditional pedagogical practice.
3. To investigate the differences in students' motivation in between learning Chinese characters using improvised low-cost Wiimote Interactive Whiteboard and traditional pedagogical practice.

### IV. MATERIALS AND DATA COLLECTION METHODS

#### A. Hardware setup

Improvised Low-cost Wiimote Interactive Whiteboard is a great solution that helps most schools to afford an IWB. The improvised low-cost wiimote IWB is based on Johnny Chung Lee, a PhD student from Camegie Mellon University, develops that idea. The Wiimote is the game regulator of the Nintendo Wii operation process that is cost about USD\$40. It is featuring the essential components that make the low-cost IWB possible.

To set up the improvised low-cost interactive whiteboard using the Wiimote, the following tools were required:

- Nintendo Wii Remote
- Infrared pen with a momentary switch
- LCD Projector
- Personal computer running Microsoft Windows XP or later
- Bluetooth dongle
- Projector screen
- Wiimote software

To operate the low-cost wiimote IWBs, the infrared camera that can directly projected to the screen aimed. Teachers need to use pen (with infrared LED) and directed to the laptop by using bluetooth function in the laptop. Users need software to calibrate and received a signal from the Wiimote. A schematic diagram of Wiimote whiteboard concept is shown as in Figure 1.

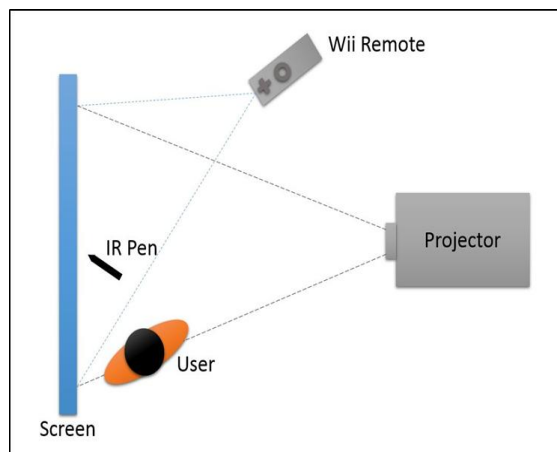


Figure 1: Improved Low-cost Wiimote IWB Concept

#### B. Connecting the Low-cost Wiimote to the computer

Firstly, low-cost Wiimote was paired with a computer via Bluetooth and detected as a Bluetooth peripheral device on the computer. Meanwhile, the battery cover of the low-cost Wiimote was opened and sync button was pressed, the four LEDs started blinking. Later, the device was found and showed listed on the device in the computer screen. Then the low-cost Wiimote was paired without a passcode. Finally, the four LEDs at the bottom flashed and the low-cost Wiimote made into in the list of connected Bluetooth devices on the computer.

#### C. Placement of the Low-cost Wiimote

After the Bluetooth pairing, Wiimote was placed in an ideal position. Since the concept of Wiimote whiteboard is tracking the infrared light from the pen, the Wiimote was placed in a position where it could “see” the entire screen, and was not blocked by any objects, including the user. Therefore, the Wiimote was put in about 45 degrees, 2 meters away from the screen. Wiimote had to be placed diagonally so the hand and body could not block the Wiimote.

#### D. Constructing the Infrared Pen

The infrared pen can be purchased online. It has better quality and comfortable to use, but it is expensive (around USD\$20). However, it can be made in the DIY method. To make the Wiimote whiteboard a lower cost, a DIY infrared pen can be made. To construct the infrared pen, the required tools as listed below:

- Artline marker pen
- Vishay TSAL6400 LED
- Momentary switch
- Thin wires
- AAA size battery and holder
- Soldering kit
- Drill



Figure 2. Screenshot of the setup and design of teaching and learning to write Chinese character using improvised low-cost Wiimote IWB

#### E. Software Setup

To allow the computer to know the x and y-position of the infrared light, a software was installed to do the calibration. It is a mandatory step before the user starts using Wiimote Whiteboard, and when the Wiimote controller is displaced. However, calibration is not necessary if the Wiimote controller is permanently fixed at a place.

There are 3 software could do the calibration: Wiimote Whiteboard or WiiTUIO or Smoothboard. In this study, Wiimote Whiteboard v1.3.1.11 was used as it is free, easy to setup and use. It is used to calibrate the Wiimote with the infrared pen and turns the position of infrared light into the coordination of the cursor. It works on multiple platforms and works well with other software, such as Microsoft PowerPoint, Open Sankoré and any handwriting utility software.

#### F. Students' achievement

The pre and post test result on students' achievement in Chinese characters was measured through the “listen and write” test score and comparison will be carried out to identify the differences. The test has been carried out during the study is the “listen and write” test, where the teacher read the Chinese characters that students learnt, and students had to write them out. For instance, when the teacher read the character “我”, the students would have to write “我”. Students were tested 10 vocabularies with 2 to 4 characters in each test in a duration about 8 minutes. Score was given to the students write it correctly, and the score is the percentage of correctly written vocabulary. Prior the experiment, the 4 previous results of students' “listen and write” test score was taken as the pre-test score of both treatment and control group.

In this study, only 4 tests were carried out for post-test data analysis, this was because researcher had a limited time for the experiment. The result is the significance value between the mean score of 4 “listen and write” post-test score of both control and treatment group.

#### G. Students' motivation

This study used Motivated Strategies for Learning Questionnaire (MSLQ) to

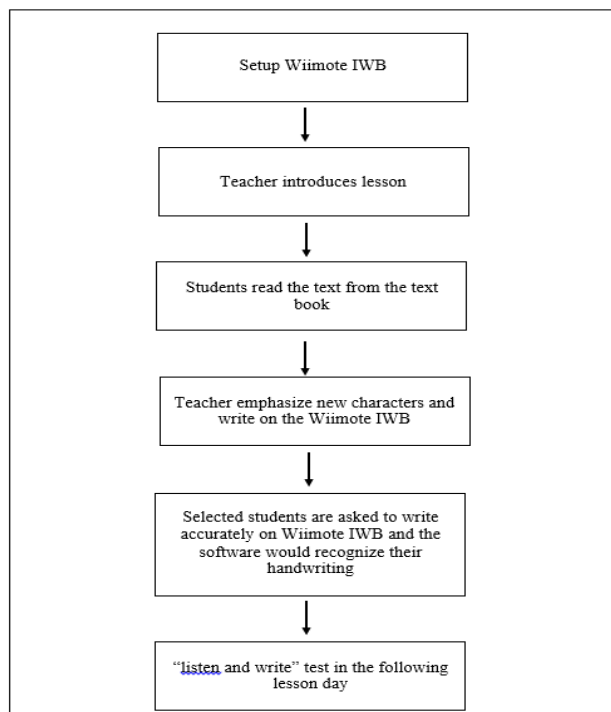




identify students learning motivation in this study [15]. MSLQ is an 81-item self-report questionnaire that measures varied psychological aspects of a specific course developed by [15]. The MSLQ consists of 2 parts: Part A for motivation and Part B for learning strategies. From the 81-item questionnaire were used to analyse the motivational orientation of the students. Some of the items were excluded in this study because they are not related to the research objective [15-16].

The motivation items like "I expect to do very well in this class," "I am sure that I can do an excellent job on the problems and tasks assigned for this class," "I know that I will be able to learn the material for this class" [17-18]. "I think what we are learning in this Science class is interesting") and ("It is important for me to learn what is being taught in this English class" [17] and followed by ("I prefer class work that is challenging so I can learn new things". Other items like "I am so nervous during a test that I cannot remember facts I have learned," "When I take a test I think about how poorly I am doing" [19].

As the participants were mainly Chinese primary school students, the questionnaire was provided in bilingual: English and Chinese. According to Pintrich (1989), a higher score (4,5,6,7) is better than the lower score (1,2,3). If the mean score is a higher score, the participants are assumed to have more motivated on the lessons. In this study, a 4-level scale will be used to reduce confusion among primary school pupils, where a higher score (3,4) is better than the lower score (1,2). The study employed four-point scale as to avoid desirability bias and reduce the chance to answer midpoint on a five-point format [20-23].



**Figure 3. Lesson flow for teaching and learning using improvised low-cost Wiimote IWB**

## V. RESEARCH RESULTS AND DISCUSSIONS

This analysis is to respond to the research question "What are the differences in students' achievement in between

learning Chinese characters using low-cost Wiimote IWB and traditional pedagogical practice". Four tests were carried out and analysed as the post-test score result after teaching and learning as shown in Fig. 3.

Table 1 shows the outputs of the t-test analysis on post-tests between the groups teach with improvised low-cost wiimote IWB and compare with traditional teaching practices group (control group). The results revealed that the mean score for the treatment group was 79.20 and the mean score for the control group was 73.48, and there was no difference between both groups ( $p=.294$ ;  $p > .05$ ). This indicated that two groups had not exhibit a significant difference in terms of students' achievement in writing newly learnt Chinese characters regardless of the use of low-cost Wiimote IWB.

For the motivation findings, the treatment group has mean score of 3.02, and control group has mean score of 2.98. Based on the t-test result using the SPSS software, researcher found that low-cost Wiimote IWB does exhibit significant difference in students' motivation in learning Chinese characters by comparison with traditional pedagogy. The findings indicated that not show significant different between groups as  $p=.0809$  ( $p > .05$ ). The result is shown in Table 2.

**Table 1**  
*The post-test result between the treatment group and Control group.*

	treatment group (n=23)		control group (n=23)				
	M	SD	M	SD	df	t	p
post-test	79.20	17.93	73.48	18.65	44	1.06	.294

*The mean difference is not significant at 0.05 level*

**Table 2**  
*T-test Analysis on Students Motivation*

	Treatment group (n=23)		Control group (n=23)				
	M	SD	M	SD	df	t	p
MSLQ	3.02	0.54	2.98	0.55	42	.234	.809

*The mean difference is significant at 0.05 level*

## VI. CONCLUSIONS

Interactive whiteboard has provided many great features and functionality that help teachers teach and students are able to learn faster, so the most effective lesson will be achieved. But not many schools in Malaysia are able to pay for costly interactive whiteboards due to limited funding by the government. Hence, it is difficult and impossible to install in all classes. Therefore, a solution that can help schools to have an interactive whiteboard in the classroom is by using Wiimote Interactive Whiteboard (Wiimote IWB). This study aims to identify the usability and effectiveness of improvised low-cost wiimote IWBs as learning tools for TCSL for low primary pupils in Malaysia settings. The use of improvised low-cost wiimote IWBs is similar to the ordinary IWBs in the

market.

Based on the data analysis for students' achievements in learning Chinese characters, both group have not significant different in there Chinese language performance. This concludes that the use of improvised low-cost Wiimote IWB did not determined the overall students' achievement in a class. However, in term of pre-post comparison, the treatment group did show a significant improvement prior the use of Wiimote IWB. This indicates that some individuals might have improved due the use of Wiimote IWB but it might be also due to other factors such as intensive practice and memorisation.

For students' motivation, the treatment group that had improved low-cost Wiimote IWB for teaching and learning also did not show any significant difference in motivation is partly because not every student got the chance to write using the tool. Due to limited lesson time, therefore not every student was able to get chosen by teacher to try on the board. Besides, not every student was amused with the gadget too. Certain students found it difficult to write on the board, especially the left-handed students; this is because the way they hold the infrared pen was easily blocked the infrared pen to be tracked by the Wiimote. Furthermore, some students also found that Chinese character lesson is boring. Nevertheless, the main factor that contribute to that outcomes were the teaching method is still the same as used to be before the experiment, where the only difference is the whiteboard which both the group used.

However, undoubtedly, improvised low-cost Wiimote IWB is a low-cost alternative which has potential to replace the expensive interactive whiteboard that many schools and teachers could not afford. The improvised low-cost Wiimote works exactly as the other branded interactive whiteboards. However, there are unavoidable physical and technical issues and drawbacks which made Wiimote IWB more difficult to setup and use than the conventional interactive whiteboard.

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