THE IMPACT OF INTERACTIVE WHITE BOARD IN THE TEACHING AND LEARNING OF MATHEMATICS (IN PRIMARY AND SECONDARY SCHOOLS IN WARRI SOUTH LOCAL GOVERNMENT AREA OF DELTA STATE)

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Abstract
An interactive white board is a tool that provides flexibility in the teaching of mathematics and mathematical concepts in classroom. It allows mathematics teaches the opportunity to present to their student's multiple visualization and multimedia presentations. The advent of this new material has made it easy for mathematicians to properly explain abstract concepts in mathematics to their students. The purpose of this study is to access the impact, affordability and usage of Interactive White Board (IWB) in Warri South Local Government Area of Delta State in comparison to the normal traditional black or white board, as it affects the teaching and learning of mathematics. A questionnaire including 100 participants was given out and the result showed that, though the use of interactive white board greatly enhanced the understanding of mathematical concepts in schools where they are used, most private and public schools could not afford it and thus most mathematics teachers have not seen the IWB not to talk of using it. The IWB is also called the Smart Board.

Key words: interactive, whiteboard, concepts, impacts, affordability, access, smart board.

Introduction

That technology has greatly influence and affected education in our country and other parts of the world is not a new fact. The advent of this rather new technology called the Interactive White Board (IWB) is one of such contributions of technology to education. In other parts of the world, the use of Interactive White Board has been greatly studied and its impact on the teaching and learning of various aspects of education   cannot   be over emphasized (Sonnier, 1989; Parkinson, 2004; Beswhik, 2007, Litteton, 2008, Miller, 2008; Glover, 2009, and Essig, 2011) The general attitudes toward the use of the IWB is that it reinforces participation, motivates learners and make teaching more interesting for the teachers (Simth, 2005).

It is beenconfirmed that theuse of IWB in other disciplines (especially the sciences) has the potential to provide a wide range of activityfor learners. According to
Zevewnbergen   and   Lernmun,   2007, classroom activities not only increased learner engagement but also facilitate the teaching and learning process. Other studies on the influences on IWB on learner achievement revealed   that   students   and   evenpupils achievemore whenIWB was employed in

teaching difficult concepts (Watson & Miller, 2009).

In interactive white board have three components;

1. A computer
2. A projector
3. The white board

One interesting part of the interactive white board is thing that can be done with a normal computer can be done with the interactive white board andmuch more these includes;

- The internet browser
- World documents
- Video chips
- Charts and pictures and any other thing that can be done on the computer. The projector, projects and images on the white board and you can then interact with the image.

Most interactive white boards have a pen. The pen works like a mouse. Some interactive white boards allowyou to use your pen, which works the same way as the pen or the mouse. There are three main interactive white boards' manufacturers:

i. Hitachi
ii. Smart
iii. Promethean

Each white board comes with its own ship chart software.

How to use the interactive white board Steps

1. Put on the mano computer, put on the white board, and the projector.

2. From the interactive white, using the intelligent pen or your fingers, choose the particular software that the system you are using provides.
3. Calibrate your pen. To calibrate the pen is to focus the pointer of the pen or the pen or your finger so that the white board will carry out your instruction as pointed by the pen or your fingers with high provision. Once youenter the calligraphic mode, the interactive board will show a set of 9 points. You are to place the pen on the center of each point from the 1st to last. When you finish the system will score you and you can then do any work you wish on the system.
4. You can now choose any other thing you want to do from the tool bar in the right, left or bottom.
5. You can save or record your work as syou use the interactive board.
6. Any file or work saved can be retrieved any time.

Types of InteractiveWhiteBoards There are many types of Interactive White Boards.

Common Operation Types
Technologically, IWBs may use one of the several types of sensing technology to track interaction on the screen surface. Globally, the majority of IWBs sold involve interaction between the user and the content projected on the white board. These are: resistive, electromagnetic, infrared optical DST ultrasonic camera-based (optical) technologies.

1. ***Restive touch-based IWB***: Touch screens are made up of two flexible sheets coated with a restive material and supported by a microthin air gap.

The two sheets are pressed together, when contact is made to the surface of the touch screen. This technological system gives room for one to employ a finger, a stylus or any other pointing device on the surface of the board.

2. *An electromagnetic pen-based IWB*: It contains an array of wires embedded behind the solid board surface which interacts with a coil in the stylus tip to determine the horizontal and vertical coordinates of the stylus. The pen itself is usually passive (i.e. it has no battery or other power source); it alters the electrical signals produced by the board. Thus, this type of IWB is named an Active Electromagnetic board (AEB). In other words, there are magnetic sensors in the board surface that react and send a message back to the computer when they are activated by a magnetic pen (stylus). Styli are either active (require a battery or wire back to the white board) or passive (alter electrical signals produced by the board, but has no battery or other power source). In contrast to an AEB, there is another form of an electromagnetic board called a passive electromagnetic Board (PEB). PEB does not have the sensing technology in the board itself rather in the stylus- pen. Tiny magnetic fibres are embedded in the white board and form a pattern that an electromagnetic coil in the pen is able to sense. So the pen is capable of calculating its location on the whiteboard and sends this information to the computer.

3. *Capacitive white board*: Just like the electromagnetic type described above, the capacitive type works with an array of wires behind the board. It is a touch-based IWB. That is the wires interact with fingers touching the screen. In this case, the interaction between the different wires (laminated in a patented X - and Y- axis manner) and finger tip is measured and calculated to a (X, Y) coordinate. However, projected capacitive is another type that uses an Indium Tin Oxide (ITO). The newest type in the world market uses transparent electrodes substituting the ITO.

4. *Infrared optical-based IWB*: an infrared interactive white board is wide interactive display surface board that connects to a computer and projector as well. Typically, the board is placed on the wall or floor stand. Infrared optical-based IWB is also touch- based projected on the whiteboard surface is captured by its interference with infrared (IR) light at the board surface. When the white board surface is pressed, software then manipulates the information and triangulates the location of the marker or stylus. This technology allows white boards to be made of any material; with this system no dry-erase marker or stylus is required. It may be found useful in different levels of classroom education, corporate board rooms meetings, training centre, broadcasting studios, activity rooms for organizations etc. Others with optical-based TWB come in

different forms with little differentiable technological make-up or technological advancement. These are: laser light curtain, ultra short-throw projector (projector/laser light curtain), frustrated total internal reflection, will remote IW13s as well as a camera optical -based IWB (camera pen and dot pattern).

5. *Laser light curtain IWB*: This type of optical-based IWB has an JR laser located in each upper corner of the white board. The laser beam is to sweep across the white board surface just like a light house that sweeps Light across the ocean. The laser device uses a rotating mirror. While the reflectors on the stylus or marker reflect the Laser beam back to the source and the (X, Y) position can be triangulated. This technology may be combined with a hard (usually ceramic on steel) surface, which has long life and clearly erases styli and markers used must have reflective tape to work effectively and efficiently, but they are passive.

6. *Projector/Laser light curtain IWB*: It is an optical-based IWB that possesses a dual JR laser device positioned in the top middle area of a flat surface white board. The projector (normally an ultra-short throw projector) has a built in camera with a JR filter that scans the projected area. This is one of the few optical technologies that does not require a reflecting frame in the perimeter of the projected area to work and is located in each upper corner of the white board. Markers and styli used re passive but with reflecting tape to function.

7. *Frustrated total internal reflection (FTIR) IWB:* This optical technology has a JR light which bounces within flexible and transparent white board surface. Through finger press on the surface, the surface is deformed and the internal reflection is also disrupted and the Light escapes the surface where it is then sensed by projected cameras. Image processing software turns the light spots observed by the camera into mouse or pointer movements in the computerized system.

8. *WII remote IWB:* This is also an optical-based technology which is linked to computer via its Bluetooth connection capabilities. It has an open-source software and JR-pen (a pen made with momentary switch source and an JR led). The will remote detects a mouse click at the screen location of the JR-pen; once it is calibrated. The will remote was first invented and as IWB by Johnny Chung Lee, Ph.D. in 2007. And surface be it desk, wall, floor, LCD or white boards can serve as IWB.

9. *Camera pen and dot pattern IWB*: These are optical-based anoto technologies. Since the white board is passive (having no electronics or wiring); rather the pen has the electronics or wiring. These IWBs have a microscopic dot pattern

embedded in the writing surface. A wireless digital pen contains an JR camera which reads the do$ pattern to determine the exact location on the board. The digitalized pen employs this pattern to store the handwriting and upload it to a computer system.

10. *Dispersive signal technology (DST) IWB*: This is an electrically- based signal technology. In other words, it is not an optical technology. It is a touch—based IWB. In terms of functionality, a touch is activated by a finger or stylus touching the glass substrate and creating a vibration. The vibration radiates a bending wave via the substrate from the point of contact and spreading out to the edges of, the board. Sensors mounted in the corners detect the vibrational energy and convert it into electrical signals using advanced Digital Signals Processing and Proprietary Algorithms (DSPPA); we are capable of applying dispersion correction algorithms to analyze the signals and report an accurate touch on the board screen.

11. *Ultrasonic-based IWB*: This type of IWB is an ultrasonic technology which involves the use of ultra sound production system via ultrasonic wave's transmission. Typically, it is of two forms: the ultrasonic only and hybrid ultrasonic and JR-based IWBs. The ultrasonic only have two ultrasonic transmitters in two corners and two receivers in the other two corners. While the ultrasonic waves are transmitted by the white board surface. The ultrasonic is also touch-pen-based technology. That is, when the white board is touched with a pen or finger caused reflecting waves created by some little marks in the white board borders to be suppressed and the receivers communicate the fact to the controller.

Furthermore, a hybrid ultrasonic and 1. R - based technology allow white boards to be made of any material (desk/wall/floor LCD/white board) but needs a suitably adapted active dry-erase marker or stylus. When the white board surface is pressed with a marker or stylus, the marker or stylus sends out both an ultrasonic sound and 1. R light. The sound would be received by two ultrasonic microphones and the difference would be measured in the sounds arrival time and triangulate the location of the marker or stylus.

Forms of Projection System IWBs are generally available in two forms; namely: front projection and rear projection systems. The front projection IWBs has a video projector in front of the white board. The potential problem of the front projection Is that the presenter standing in front of the IWEI screen surface has to extend his/her arm with or without a stylus so as to avoid casting a shadow on the screen surface. Unlike the UST (Ultra Short Throw) projectors that cast an image from above and just in front of the front o IWB surface, thereby removing the presenter from the beam's path.

Besides, rear projection lWl3s locate the projector or emissive display behind the white board sensing surface so as to avoid casting a shadow on the screen board surface as the presenter presents or teaches programme on

the white board. In rear projection system the presenter does not have to look into the projector light while talking to the audience or learners. Generally, and significantly, rear projection systems are more expensive than front projection board. They are also very large in size and cannot be mounted flush on a wall; rather in-wall installations are possible. Meanwhile, an option to raise and lower the display (1W13) to accommodate users of various heights is also made available by some manufacturers.

Accessories

The IWBs have the following associated equipment:

Remote Control: It allows the presenter to control the board from different parts of the room and removes on-screen toolbars.

Video Projector: Allows a computer display to be projected onto the white board. E.g. UST projector minimizes shadow effects and even more effective.

Wireless Unit: Allows the IWB to operate without wires to the computer. E.g. Bluetooth.

Mobile Stand: Allows the IWB to be moved between rooms or places.

Floor Stand: Allows the IWB to stay put while in use.

Track: Allows the IWB to be placed over a traditional white board or track board to provide additional wall space at the front of the room. Some tracks provide power and' data to the white board as well.

Printer: Allow copies of the white board notes to be made available to learners/audience.

Slate or tablet: Allows learners control of the white board away from the front of the room.

Personal Response System (PRS): Allows learners to answer test questions posted on the IWB or take part in polls and surveys.

Types of IWBs available in Nigeria and their cost

1. Ebeam Edge Wireless - ₦240,012.50
2. Smart Technology smart board 480 - ₦646, 050.58
3. Smart board SBM 680 Interactive White Board - ₦390,050.00
4. Ebeam Edge + with long throw projector + Mount - ₦450,050.0
5. Ebeam edge + with short throw projector + mount - ₦540,522,50
6. Hitachi starboard fx-79E1 79+long Throw projector + mount - ₦551,500.00
7. Promethean active board touch 88 - ₦991, 512.00
8. Hitachi starboard FX – 79 E1-S-Bundle - ₦659, 500.00
9. BENQ RP552H - N946, 061.20
10. Promethean active board 587 PRO - ₦1,132, 452.86

Data Collection

The data in this study were accumulated through a questionnaire. The questionnaires were given to all the teachers in some selected government and private primary and secondary schools in Warri South. Ironically over 80% of the teachers said they have not used the interactive white board in their life. So the response was from the few schools that

have used the IWB. Each participant responded to the same question twice; that is when they teach using the traditional black or white board and when the teach using the IWB. They were asked to access the pupils and students along the following parameters.

i. Classroom management
ii. Learning pace (fast or slow)
iii. Produced excitements
iv. Classroom activities
v. Attention span
vi. Perceived comprehension
vii. Teaching efficiency
viii. Motivation and enthusiasm
ix. Increase participation
x. Increased interactivity

They were asked to score each item (I to x)

above on ascale of 1 to 10

Each teacher is required to rate the above parameters during and after theclass on a scale of 1 to 10. The acuminated result for each school parameter above is as shown below.

Nursery primary school result

i. Classroom management
   Black or White board   -   46%
   IWB   -   89%
ii. Learning pace or speed
   Black or White board   -   37%
   IWB   -   86%

iii. Excitement produced
   Black or White   -   31%
   IWB   -   85%
iv. Classroom activity/participation
   Black or White board   -   35%
   IWB   -   88%
v. Ability to understand difficult mathematical concepts

Black or white board   -   46%
IWB   -   71%
vi. Increased teaching efficiency
   Black or white broad   -   46%
   IWB   -   75%
vii. Motivation for more work
   Black or white board   -   37%
   IWB   -   87%
viii. High level of concentration
   Black or white board   -   42%
   IWB   -   97%
ix. Increased enthusiasm to study mathematics
   Black or white board   -   32%
   IWB   -   91%
x. Increased interactivity
   Black or white board   -   38%
   IWB   -   82%

Secondary Schools

i. Classroom management
   Black or white board   -   59%
   IWB   -   74%
ii. Learning pace or speed
   Black or white board   -   22%
   IWB   -   71%
iii. Excitement produced
   Black or white board   -   22%
   IWB   -   70%
iv. Classroom activity and participations
   Black or white board   -   34%
   IWB   -   73%
v. Ability to understand difficult mathematician concept
   Black or white board   -   33%
   IWB   -   71%
vi. Increased teaching efficiency
   Black or white board   -   28%
   IWB   -   75%
vii. Motivation for more work
   Black or white board   -   24%
   IWB   -   78%
viii. High level of concentration

Black or white board   -   36%
IWB   -   79%

Analysis of secondary school result A close look of the parameters shows that the traditional method is very low in learning pace, excitement produced and motivation for all others. A score of less than 25% is indeed very disturbing. More disturbing is the fact that nothing is been done about these facts. Though the IWB percentage for the secondary school students are not as high compared to those of the primary school, it is quite obvious that all the scores for IWB are above 70%.

Analysis of Primary School Result

A close look at the primary school result revealed that the percentages of learning pace, classroom activity, motivation for more work, increase enthusiasm to study mathematics and increased interactivity are all below 40%. These parameters are however very important for pupils since at this stage of their learning process building their INTEREST is of paramount importance. It is quit clear why increased enthusiasm, level of concentration, class room participation and class room management are very high. This is because the IWB is like a big television screen to them, thus raising their interest.

Conclusion and Recommendations

It is obvious from the analysis above that the traditional method of teaching (using the black board or white board) scored below its counterpart; the IWB. It is quite embarrassing that over 98% of public schools in Warri South Local Government Area and over 96% of private schools in the local government have not seen the interactive white board. With all the benefits of the smart board one will expect that every school in the local government to have at least one (1) IWB.

The case of a school in Warri South Local Government, Hussey College, is very pathetic. The government actually built an ICT center for the school, but since the day it was built (over two years ago) it has not been opened once. The reason is that the contractor is yet to officially hand it over to the school. He claims that the state government is yet to pay him. The state government and other well meaning individuals and agencies should please provide each school in Warri South and infact the entire state with at least one interactive white board so that our pupil and students can;

i.   learn faster
ii. participate actively in the school work
iii. be motivated to do more school work
iv. have increasedenthusiasm to study mathematics and
v. assist the teachers to effectively teach difficult mathematical concepts to all the pupils and students in the state.

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