International Journal of Engineering Inventions
e-ISSN: 2278-7461, p-ISSN: 2319-6491
Volume 4, Issue 11 [July 2015] PP: 15-20

Relevance Of Designing And Developing An Improvised White Board Compass For Teaching Geometrical Construction Concepts In Basic Technology

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Abstract: - This study described relevance of designing and developing an improvised white board compass for teaching geometrical construction concepts in basic technology. This study also incorporated the methods and approaches of design and development research (DDR) as first proposed in Wang & Hannafin, (2005) and Markauskaite & Reimann, (2008) work as a method in educational research meant to test theory and practicality. Therefore using creative strategies, and models to set important elements, theories and principles that can create learners participation, skill transfer, technical and classroom dynamics, an improvised white board compass was developed for this study and meant to enhance a more learner centered and constructivist approach to the teaching and learning of geometrical construction concepts. Based on this, relevant conclusion was made and recommendations given regarding the Federal Government (FG) improvement on fuel cost reduction and constant electric power supply to reduce the high cost of production which is detrimental to the development of any Nation's economy.

Keywords: *Relevance, Designing, Developing, Compass, and Basic Technology*

I. INTRODUCTION

In Nigeria, there exist various geometrical construction concepts in Basic Technology curriculum contents that necessitate the use of graphic instrument like compass, for effective teaching and learning processes. Prior to the introduction of white board as an innovative writing media, in some Nigeria secondary schools, the medium of making available to learners, relevant instructions was chalk and dark board (Ogunmade, Okediyi, & Bajulaiye, 2006). This was a monotonous approach to instruction as it made teachers hand and hair rough and dirty (Ditto).

Before this invention, chalk and dark board compass was in vogue for teaching geometrical construction concepts, and with the introduction of an innovative formica media (white board) it became obsolete and irrelevant in most secondary schools in Nigeria, as an instructional media for teaching and learning processes (Adu, 2011 and Adu, 2005). Improvisation refers to the process of creating something in the absence of the ideal tools. It is the process of providing, selecting or making substitute for something not available for use as a teaching and learning media (Ogunbiyi, Okebukola, Fafunwa, 1990). It was evident in a study of the effect of improvised and standard media on secondary school learners academic performance in Nigeria that improvised media had almost the same effect as standard media (Onasanya & Omosewo, 2011).

Owolabi & Oginni, (2012) also discovered that there were significant differences in the performance of learners that were taught with improvised media and those that were not taught with improvised media because students taught with improvised media performed better. Improvisation reduces money spent on purchase of instructional media in educational institutions, ensures the realization of lesson objectives, helps in solving the problem of inadequate instructional media in educational institutions, gives room for teachers to demonstrate his or her creative skills, allow the use of cheap local media as alternatives to expensive foreign ones, encourages learners towards the development of creative abilities, strengthens enquiry, discovery, and investigative method in sciences, provides frame of reference on which learners can focus their attention during classroom activities, and enables teachers to think of cheaper, better and faster methods of making teaching and learning processes easier for learners (Nor Aziah, 2007, and Oblinger & Oblinger, 2006a).There are seven strategies of improvisation and they are : trust, acceptance, attentive-listening, spontaneity, story-telling, non-verbal communication, and warm-ups (Gessell, 1997, Koppett, 2001,Keefe, 2002).

II. LITERATURE REVIEW

Relevance of Designing and Developing an Improvised White Board Compass for Teaching.

Relevance is the property or state of being relevant or pertinent (English, 2014). The improvised white board compass is relevant because of the following reasons:

1. It supports more effective and easier teaching of the geometrical construction concepts in Basic Technology.
2. It supports the constructivist theory of teaching and learning process, by allowing learners to emulate the teacher as he or she demonstrates on the white board.
3. It assists learners in collaborative learning of geometrical construction by allowing them to work alongside their peers during practice.
4. It facilitates easier retention of the geometrical construction concept because the learners have the opportunity to visualize the demonstrations by teacher.
5. It serves as a unique tool for teaching geometrical construction concept on a white board because this invention is not commercially available based on market survey by this study in Nigeria.
6. It removes monotony in the teaching of geometrical construction concepts using white board surface because learners' are practically engaged throughout the lesson session.
7. Teachers are able to adopt a systematic approach to the teaching and learning of geometrical construction concept by using various models.
8. It increases learners' performance in the geometrical construction concepts because they are more motivated in the course of instruction.
9. The design and development of this improvised compass give the teacher sense of invention in the field of education.
10. The design and development of this improvised compass is relevant to the more rapid growth of the psychomotor domain of learning of the learners'.

III. THE USE OF IMPROVISATIONAL STRATEGIES IN THE CLASSROOM.

There are four major instructional reasons for using improvisation in the classroom:

(1) It is consistent with the characteristics of the current genres of the learners known as "Net Generation" (Carlson, 2005, Junco & Mastrodicasa, 2007, Oblinger & Oblinger, 2006a, Palfrey & Gaser, 2008, Tapscott, 1999, 2009, Howe & Strauss, 2000). This generation has grown up with the technology, especially their desire to learn by inductive discovery, experiential knowledge and collaborative teaching.

(2) It taps into learners multiple and emotional intelligence.

(3) It foster collaborative learning by helping to build trust, respect, and team spirit as well as listening, verbal and nonverbal communication, ad-libbing, role-playing, risk-taking and storytelling skills (Berk, & Trieber, 2009 and Lidia, & Sara, 2010).

(4) It promotes deep learning through the active engagement with new ideas, concepts or problems, linking the activities or tasks to prior learning, applying the content to real-life applications, and evaluating the logic and evidence presented (Atkins, 1993, Book, 2002, Diggles, 2004, Gwinn & Halpern, 2003, Lynn, 2004, Polsky, 1997, Spolin, 1999).

Improvisation involves teachers creating a physical reality through manipulative actions and emotions and at the same time ensuring that it soothes the learners learning experiences (Atkins, 1993 et.al). Spolin, (1999) stated that the goal of improvisation is to solve a problem and the power of improvisation lies in being active at all times. Thus, the improvised compass by this study is meant to engage learners' actively by practical representation of geometrical figures and shapes on white board in the course of instruction (Ditto).

IV. THE MEANING AND CONCEPT OF TEACHING GEOMETRICAL CONSTRUCTION.

Geometrical constructions are drawings or designs relating to geometry, which are made up of lines and simple shapes (English, 2014). The first proportional compass invented was in the mid sixteenth century while Galileo invented a geometric compass in Padua in 1597 (Wiki, 2014).The meaning of the concept geometrical construction is still relevant in today's Basic Technology curriculum. Although we now have computer software such as Geometer's Sketchpad that can replace the compass and straightedge for actually carrying out geometrical constructions, such software is designed to produce constructions that are exactly the same as those that can be achieved with a straightedge and compass. Such computer programs also have capabilities to:

1. Measure angles, lengths, distances, and areas in a figure.
2. Enhance the display of a geometrical figure with shading, color, labels, and explanatory text.
3. Perform geometrical transformations such as rotations, translations, dilations and reflections on geometrical figures.

4. Change a geometrical construction dynamically, that is, change the positions and distances between components of the given figure while still maintaining the prescribed relationships between constructed components of the figure, (Urbana, 2013).

To learn geometry without using geometrical construction is like trying to learn chemistry or biology without using laboratories. Basic knowledge and skills on geometrical construction help learners' to discover and explore geometrical relationships and interpret geometrical concepts and theorems (Muhammad, Nor, Zawawi, & Nurulhuda, 2012).

V. DESIGN AND DEVELOPMENT RESEARCH (DDR) AS EMPLOYED APPROACHES

The employment of design and development research (DDR) methodology as employed approach is justified in this study by its pragmatism in testing theories and validating the practicality. Besides, it is described as a way to establish new procedures, techniques and tools based on specific needs analysis (Richey & Klein, 2007). This methodology was also formerly known as developmental research by Richey, Klein & Nelson, (2004), designed case by Reigeluth & Frick, (1999), design-based research by Reeves, (2006), and Herrington, Mckenney, Reeves, & Oliver, (2007), formative research by Nieveen, (2007), and design research by Bannan-Ritland, (2003), and Van der Akker, (2007).

Although several terms have been introduced to explain and describe this research method within its similarities and differences, it was first proposed as an extension to other educational research methods in Wang & Hannafin, (2005), and Markauskaite & Reimann, (2008). It is meant to test theory and validate its practices (Richey & Klein, 2007). It is also employed to design and develop an intervention such as computer programmed instructional packages, teaching, learning, products, systems and materials strategies, with the aim to solve a complex educational problem and to advance them (Plomp, 2007).

The design and development of the improvised compass had not been an easy task of culling out the plan, because it involved thorough scrutiny using the analysis of extensive literature, collaboration and partnership between different learners', experts,' instructional designers, integrated research technologies and tools. In order to build a theoretical framework for the improvised compass, analyses of theories from literatures such as Gessell, (1997), Koppett, (2001), and Keefe, (2002) were conducted. The analyses of the extensive literature were combined with the teaching experiences of the researcher in Basic Technology and reasons for failures in geometrical construction concept for years. The reports on learners' performance revealed that among the main obvious factors were poor attendance in the classroom, and weaknesses in retention and attention level in learning geometrical construction (Tessmer, 1993). These factors are mainly related to learners' learning attitude and motivation in learning geometrical construction concepts (Urbana, 2013). The design and development of the improvised compass for this study is as follow using "AutoCAD" computer package.

VI. DEVELOPMENT OF PRE-DESIGN USING AUTOCAD.

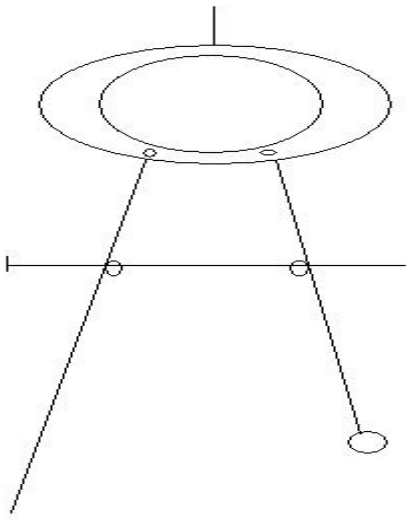

Diagram 1: Pre-Design of the Improvised Whiteboard Compass.

Final Product

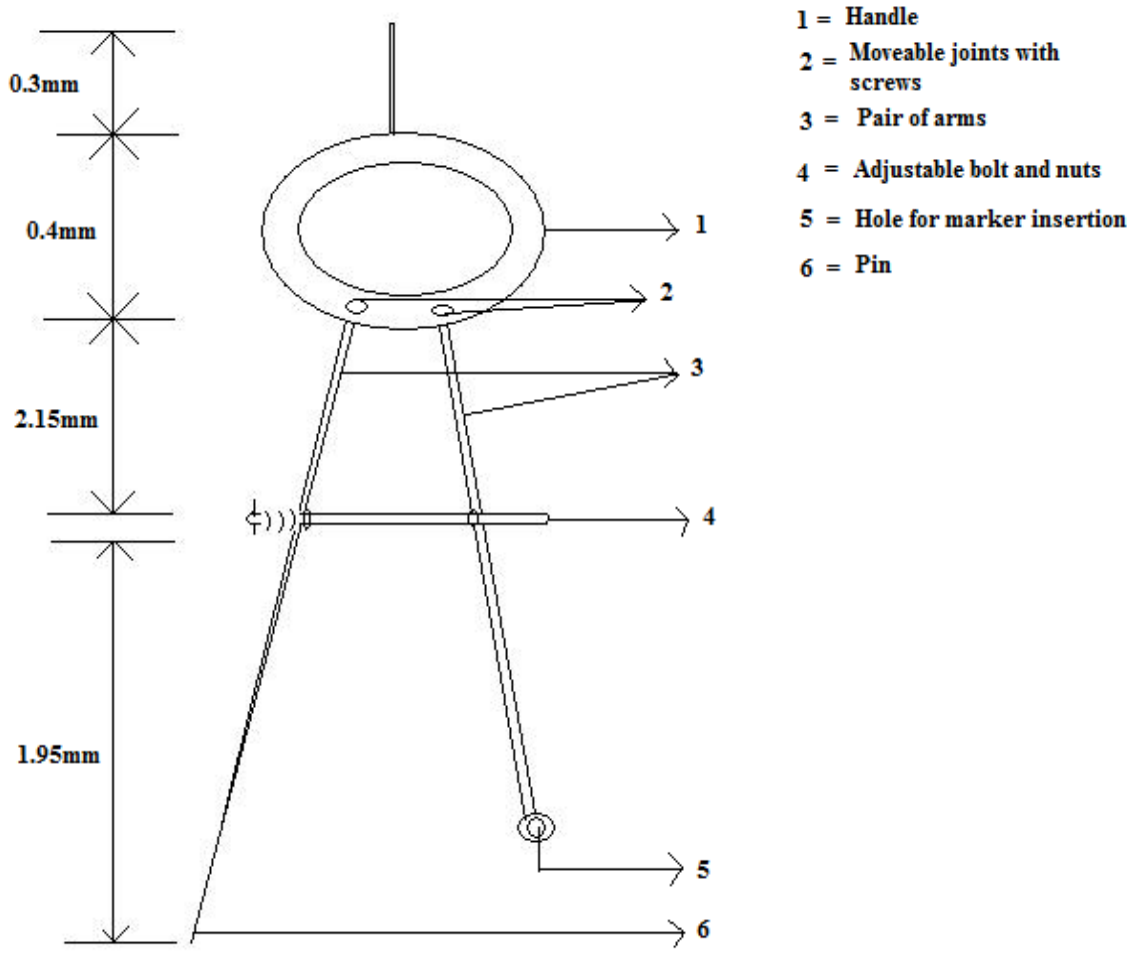

Diagram 2: Improvised White Board Compass.

VII. CONCLUSION AND RECOMMENDATIONS

This study has revealed the relevance of designing and developing an improvised compass for teaching geometrical construction concepts in Basic Technology. Nonetheless, the research was a very tedious and rigorous workshop exercise that came with challenges peculiar to erratic power supply, and high cost of fuel for powering the electric generator in the workshop during welding. Most of the materials involved in the design and development of the compass were cheap because they were locally sourced within the community, thus it is referred to as improvised compass. But the Federal Government (FG) should try in her effort in ensuring that the power sector improves to help the development of the Nation's factories and industries interested in inventions and production of new materials, because failure in doing that will result in very high cost of production which is detrimental to the health of any Nation's economy.

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