



Multimedia Instructional Approach and Gender Equity in Mathematics Achievement Among Secondary School Students

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Abstract

The study aimed at promoting gender equity in mathematics achievements through Multimedia Instructional Approach (MIA) in secondary schools in Owerri North Local Government Area of Imo State, Nigeria. The study was a quasi-experimental type adopting the pre-test, posttest non-equivalent control design. The population consist of 5917 senior Secondary school II(SS2) students. A sample of 263 senior secondary II (SS 2) students drawn from two (2) purposively selected co-educational secondary schools was used for the study. The instrument for data collection was a researcher made 30 items objective test questions titled “Mathematics Achievement Test (MAT)”. It had reliability coefficient of 0.80 determined using Kuder Richardson 20 (KR₂₀) formula. The experiment groups were taught trigonometry using Multimedia Instructional Approach (MIA) while the control group were taught the same topic using traditional method. The data generated were analyzed using Analysis of Covariance (ANCOVA) statistical tool tested at 0.05 level of significance. The result of the study revealed that Multimedia Instructional Approach (MIA) improved male and female students’ achievement in Mathematics and there was no significant interaction effect between treatment and gender achievements in mathematics. Based on the result it was recommended among others that multimedia should be employed in teaching Mathematics at secondary school level to enhance students’ achievement.

Keywords: Multimedia, Instruction, Gender, Mathematics, Achievement

Introduction

The knowledge of mathematics helps in the development of sound minds and prepares individuals to be functional in the development of any society. Mathematics as a subject prepares individuals to proffer solution to problems associated with daily activities. Mathematics is the study of numbers, symbols, counting, measurement, number patterns and relationships of quantities (Akanmu, 2017). According to Muijs and Reynolds (2005) Mathematics plays a main role in many branches of science such as physics, engineering, and statistics. This is because Mathematics is seen as the language which science disciplines depend on as they cannot exist in isolation. The teaching and learning of mathematics in secondary schools is geared towards developing the nation in terms of scientist, technologists, doctors, engineers and other professions. Mathematics shapes individuals’ intellectual dispositions. Aiyedum as cited in Onuoha, Ifelunini,

Ezeocha and Agah (2017) pointed out that Mathematics is the gate and key to science and further indicated that Mathematics can be seen as the language of sciences since most science discipline cannot exist in its isolation. The relevance of mathematics made the Federal Government of Nigeria to make Mathematics a core compulsory subject to be offered at both the primary and secondary school levels in Nigeria (FRN, 2014). Mathematics is so important that, any candidate without a credit in the subject will not gain admission to read any course in any tertiary institution in Nigeria

This all-important subject has suffered a lot of setbacks in terms of students' outcome. Obodo (2004) stated that students' achievement in Mathematics over the past decade has not been impressive. Galadima and Okogbeni (2012) indicated that despite the importance and relevance of Mathematics to the individual and the nation in general, students' performance both at internal and external examinations has continued to deteriorate year after year. Anibueze, Ayogu and Abugu (2017) stated that in Nigeria, the performance of students offering Mathematics especially at the 2014–2017 West African Senior Secondary School Certificate Examination (WASSCE) where the percentages of students that obtained credit passes and above in Mathematics is within the range of 31.28% to 59.62% despite the fact that all senior secondary school students offer Mathematics. The teaching and learning of Mathematics in recent time has encountered several challenges which has resulted to poor students' achievements. Among these challenges include, unqualified teachers, inappropriate use of instructional strategies, gender and environmental issues (Karue & Amukowa, 2013). National Mathematics Centre (2009) indicated that poor performance in the promotion/public examinations in Mathematics has more to do with teachers' method of teaching than the content of curricular of the school Mathematics. Teachers are noted to consistently stick to the use of traditional teacher-centered approach in teaching Mathematics. This approach does not liberalize or favour students as they are only passive in the classroom. According to Gambari, Yaki, Gana and Ughovwa (2014) teachers' centered method emphasizes learning through the teacher's guidance at all times. Students are expected to listen to lectures, copy notes and learn from them without making any input.

Gender is another construct that has contributed to students' poor achievement in Mathematics. For instance, Frempong and Ayia in Onuoha et al (2017) observed that female students are less successful in learning Mathematics due to their low interest and confidence in learning Mathematics and their low academic expectation. Anjum (2015) indicated that girls and boys differ in Mathematics achievement with girls outperforming boys. Arhin and Offoe (2015) also in a study on gender differences and mathematics achievement of senior high school students, found no significant difference in the mathematics achievement between male and female students from experimental group. Abiam and Odok (2006) found no significant relationship between gender and achievement in number and numeration, algebraic processes and statistics in Nigerian schools. However, a weak significant relationship in geometry and trigonometry was established. Viann (2004) investigated differences and the effects of cooperative learning in Mathematics classroom setting and found no significant gender-related differences in Mathematics achievement but female students achieved slightly higher grades than male students. Koller, Baumert and Sehnabol (2000) studied gender differences in Mathematics achievement which favoured males in achievements, interest and placement in advanced Mathematics courses. To improve students' achievement in Mathematics and address the various dichotomies associated with it, there is need to employ instructional approach that supports technology in the learning process. To support this, Ibrahim (2009) stated that, to improve the educational productivity, some of the teaching staff sought to embrace the use of multimedia instruction.



Multimedia is defined as the presentation of the learning material using both pictorial form and verbal form such as spoken and printed text (Mayer, 2000). Sharma (2013) sees multimedia as computer-mediated information that is presented concurrently in more than one medium. Ogochukwu in Nwoke, Uzoma and Ugo (2016) described multimedia as the combination of various digital media types, such as text, images, sound and video, into an integrated multisensory interactive application or presentation to convey a message or information to an audience. Multimedia is multi-sensory technology that stimulates multiple senses of the audience at a time. Its interactive nature enables teachers to control the content and flow of information (Shah & Khan, 2015). Philips (1997) stated that multimedia is characterized by the presence of text, pictures, sound, animation and video, some or all of which are organized into a coherent program. Mayer and Moreno (2003) defined multimedia instruction as presenting both words and pictures that are intended to foster learning. They further indicated that, the word can be printed (e.g., on-screen text) or spoken (e.g., narration). The picture can be static (e.g., illustrations, graphs, charts, photos or maps) or dynamic (e.g., animation, video or interactive illustrations).

Multimedia is increasingly being used in many developed countries and developing countries including Nigeria due to its advantages which includes among others: complicated topics can be explained and understood better with the aid of pictures, graphs, animations and simulations as well as complex concepts are presented in small, chronological steps as a means to improve students' ability to comprehend information in meaningful way (Adegoke, 2010; Neo & Neo, 2001). Gilakjani (2012) indicated three reasons and the rationale for the use of multimedia in the classroom. These include; its use increases students' interest level, enhances their understanding, and increases their memorizing ability. The use of multimedia in Mathematics classroom increases students' motivation and makes them active learners. According to Prabowo, Anggoro, Astuti and Fahm (2017) technology-backed learning environment motivates students to participate and to interact with others in the instructional process and their motivation makes them confident in studying Mathematics (Leow & Neo, 2014). John, Musa and Waziri (2018) opined that through multimedia teachers motivate students to learn by using their different senses and through audio-visual presentation of information, the students obtained clearer and more complete knowledge of the outside world and themselves. Skinner in Nwaocha (2010) stated that students usually learn more in classes in which they receive multimedia presentation-based instruction and that they learn their lessons in less time with multimedia presentation-based instruction. Maha (2008) indicated that schools that employed the use of multimedia instruction have higher students' attendance and lower dropout rates that leads to greater academic achievements and retention.

Irrespective of the unending efficacy of multimedia instruction in teaching and learning mathematics and other subjects, there has been no research evidence of application of this instructional mode within the area of the study to the knowledge of the researchers. This has made it pertinent to employ this technology based instructional approach in mathematics.

Statement of the Problem

Gender balance in Mathematics achievement at the secondary school level has persistently remained a mirage as revealed by various research results. Some of the results indicated the existence of gender difference in Mathematics achievement in favour of male students such as Frimpong and Ayia as cited in Onuoha et al (2017), while Schabel (2001), Arhin and Offoe (2015) and Viann (2004) showed no gender difference in Mathematics achievement or its existence in favour of female students. These inconsistent results in gender achievement in Mathematics may have a link with the instructional approaches employed by teachers which, has proven to be

counterproductive. Based on the foregoing, the study was carried out to investigate the promotion of gender equity in Mathematics achievement using Multimedia Instructional Approach (MIA) in secondary schools. Specifically, the study determined:

1. The effect of multimedia instructional approach (MIA) on students' achievement in Mathematics
2. The influence of gender on students' achievement in mathematics
3. The interaction effect of treatment and gender on students' achievement in Mathematics.

Hypotheses

Based on the purpose of the study the following hypotheses were formulated to guide the study:

- H₀₁: There is no significant effect of treatment on achievements of students in mathematics.
- H₀₂: There is no significant influence of gender on students' achievement in mathematics
- H₀₃: There is no significant interaction effect of treatment and gender on students' achievements in Mathematics

Methodology

The study was a quasi-experimental type adopting the pre-test post-test non-equivalent control design. The design was adopted since it was not possible to carry out a randomization of the participants due to the school programme.

The population of the study consists five thousand nine hundred and seventeen (5917) senior secondary II (SS2) students in the 15 Government owned secondary schools in Owerri North Local Government Area of Imo State. Based on the nature of the study, two secondary schools were purposively selected for the study since they are co-educational and possess the characteristics required for the study. In each of the schools selected two intact classes were randomly assigned to control and experiment groups respectively. This implies that, two classes were assigned to control group and two classes assigned to experiment group. This gave a total of 263 students comprised 140 females and 123 males. The control group had 144 participants made up 66 males and 78 females. The experiment group was made up of 119 participants with 57 males and 62 females. The instrument for data collection was a researcher made 50 items objective test questions titled "Mathematics Achievement Test (MAT)". The construction of the test was guided by a table of specification based on the topics taught the students. The face and content validity were determined by two Mathematics educators and a Measurement and Evaluation expert. Their inputs guided the restructuring of the instrument where necessary. To determine the reliability of the instrument, 35 copies were administered to students outside the study group in another school with the same characteristics with the study group. The data generated were analyzed using Kuder Richardson 20 (KR₂₀) formula which gave a reliability co-efficient of 0.80 which was acceptable for the study. Before the treatment commenced, the control and experimental groups were pre-tested to determine their cognitive readiness. After that, the experiment groups were taught trigonometry using Multimedia Instructional Approach (MIA) by a research assistant who was trained on the approach for one week. The content of the topic was downloaded from the internet and projected to board through a laptop. The step-by-step process of the instruction was outlined on a lesson plan to conform with the downloaded material. The approach allowed students to ask



and answer questions, practice with the instructional procedure. The researchers were on ground to ensure the treatment procedure was strictly maintained. The control groups were taught the same topic using the traditional approach as outlined on a lesson plan. The entire process lasted for 3 weeks after which a post test was administered to both groups using a rearranged version of the pre-test instrument and marked over 100%. Based on the design of the study, generated data were analyzed using Analysis of Covariance (ANCOVA) and tested at 0.05 level of significance.

Results

H0₁: There is no significant effect of treatment on achievement of students in Mathematics

Table 1: Summary of ANCOVA Analysis

Source	Type III sum of squares	df	Mean square	f	Sign
Corrected Model	48540.987	4	12135.247	326.015	.000
Intercept	17096.143	1	17096.143	495.290	.000
Covariate	48.975	1	48.975	1.316	..252
Method	47615.123	1	47615.123	1279.187	.000
Gender	19.574	1	19.574	.526	.469
Method* gender	7.855	1	7.855	.211	.646
Error	903.523	258	37.223		
Total	497137.000	263			
Corrected Total	58144.510	262			

Table 1 shows that the computed $f(258,1) = 1279.187$, $P=0.000$ is less than 0.05 level of significance under method. Based on the result, the null hypothesis is rejected. This implies that there is significant effect of MIA on students' achievement

H0₂: There is no significant influence of gender on students' achievement in mathematics

Table 1 revealed $f(258,1) = 0.526$, $P=0.469$ is greater than 0.05 level of significance under gender. This means that gender has no significant influence on students' achievement in mathematics when taught using multimedia instruction.

H0₃: There is no significant interaction effect of treatment and gender students' achievements in Mathematics.

Table 1 also shows that $f(258, 1) = 0.211$, $p=0.646$ is greater than 0.05 level of significance under method and gender. Based on the result, the null hypothesis is upheld which implies that there is no interaction effect of treatment and gender achievements in Mathematics.

Discussion

The result of the study revealed that male and female students had improved achievement in Mathematics due to the application of Multimedia Instructional Approach (MIA). The statistical analysis showed that, there was no significant difference between the achievement of male and female students taught mathematics using Multimedia Instructional Approach (MIA). This result

is in agreement with that of Akinoso (2018) which revealed that, there was no significant difference on mathematics achievement using multimedia materials based on gender. Also, the study carried out by Anyamene, Nwokolo, Anyachebelu and Anemelu (2012) on the effect of CAI packages on the performance of senior secondary students in mathematics, history and physics respectively revealed that there was no significant difference in the test performance scores of male and female students taught using CAI packages. Also, the equal achievement of male and female students in multimedia group could be attributed to factors such as, motivating nature of computer technology, cooperative nature of the approach, interactive nature of the learning approach and their learning styles, etc.

The study finally revealed that, there was no significant interaction effect of treatment and gender on students' achievement in mathematics. The result is also in line with Nwoke et al (2001) which revealed that, gender is not a factor on students' achievement when taught with appropriate Instructional approach.

Conclusion

The result of the study revealed that Multimedia Instructional Approach (MIA) was effective in improving male and female students' achievement in Mathematics and reduced the gender issues associated with Mathematics achievement.

Recommendations

- Based on the result, the following recommendations were made;
1. Multimedia should be employed in teaching Mathematics at secondary school level to enhance students' achievement.
 2. Multimedia facilities such as laptop/Desk top computers, projectors, slides, etc should be provided in secondary schools by the government to enable teachers use them to teach Mathematics.
 3. Government, non-governmental organizations and school managers should organize seminars, symposium and workshops to train teachers on the application of innovative approaches such as Multimedia approach in teaching Mathematics.

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