EFFECTS OF ZOOM APPLICATION AND GOOGLE HANGOUTS ON ACHIEVEMENT AND RETENTION OF MATHEMATICS STUDENTS IN PRIVATE SCHOOLS, IN MINNA NIGERIA

[*1]JIMOH, Muili Adeyi; [2]KAREEM, Mary Ayanjoke; [3]EKUNKE,-Unyime-Abasi Rapheal; [4]AMBODE, Akinbiyi Benard; [5]JIMOH, Fatai Olalere & [6] RUFAI, Kazeem Olayiwola

[1]Niger State Ministry of Education Minna, Niger State
[2]Secondary Education Board, Area 3 Garki FCT, Abuja
[3]Federal College of Fresh Water Fisheries Technology PMB 1500 New Bussa, Niger State
[4]Department of Science Education Federal University, Oye-Ekiti, Ekiti State
[5]Federal University of Technology Minna, Niger State
[6]Federal Science Equipment Centre, Ijanikin, Lagos State

*Corresponding Author Email: muiunique@gmail.com

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Abstract: *This study investigated the effects of Google hangouts and zoom application on achievement and retention of mathematics students in private schools in Minna Nigeria. The study adopted pre-test, post-test randomized experimental research design. The target population for the study was all the 4,571 senior secondary school two (SS II) mathematics students in private schools (2021/2022 academic session). Multi-stage sampling was used to sample the schools and random sampling technique was used to sample 171 students (93 male and 78 female) for the study. The research was guided by two research questions. Also two null hypotheses were formulated and tested at 0.05 level of significant. Research instrument that was used for the study named Mathematics Achievement Test (MAT) and it* was *validated by three experts in Mathematics Education and Cyber Security at Federal University of Technology Minna, and Computer Science at El-Amin International School Minna. A pilot study was carried out to test the research instrument using split-half method and reliability coefficient of 0.85 was obtained using Pearson Product-moment correlation coefficient (PPMC).Thirty (30) multiple choice questions were administered to all groups before and after the treatment as pre-test, post-test and retention-test. The data collected from the administration of the research instrument named Mathematics Achievement Test (MAT) was analysed using SPSS version 20.0. Mean and standard deviation were used to answered research questions while analysis of variance (ANOVA) was used to test research hypotheses. The findings of the study revealed that there was significant difference in the mean achievement scores of students taught mathematics using Google hangouts, Zoom Application and Conventional Method. Also, there was significant difference in the mean retention of students taught mathematics using Google hangouts, Zoom Application and Conventional Method. The study recommends that Google hangouts and Zoom Application should be encouraged in the schools for teaching and learning of mathematics in secondary schools.*

Keywords: Google hangout, Zoom Application, Achievement and Retention.

INTRODUCTION

Information and Communication Technology (ICT) is making dynamic changes in the society. ICT is influencing all aspects of human life and its integration in education is improving globally on daily basis. As a result of this integration, teaching and learning process is witnessing effectiveness, efficiency and improved academic performance of students which is the rationale for establishing schools (Ben & Dahmani, 2008) Information and Communication Technology (ICT) is one of the most efficient tools for advancing knowledge and skills, and it is highly

needed for quality education to take place and attention is being given to the integration of ICT driven learning process (Falode & Ajala, 2014).

The need to develop learning environment where students will be able to work effectively with people from different locations and background around the globe necessitates the adoption of video conferencing. The video conferencing has been recognized as effective delivery method in distance education between students (Lim, Cha, Park, Lee & Kim, 2012). Due to growing number of immigrants, many teachers in different counties offered or even required online teaching (Acquah & Commins, 2013; & Keengwe, 2010). In order to achieve aforementioned, very good connectivity play a very critical role in video conferencing in teaching and learning of mathematics.

Connectivity is a critical factor in mediated learning environments and in order to promote student learning, instructors must provide a platform where students can meet and exchange information freely in both asynchronous and synchronous formats (Smyth, 2011). Computer-mediated interaction can minimize the feeling of isolation among remote students and can promote a sense of community (Ferguson, 2010). Stewart, Harlow, and DeBacco (2011) also claimed that the use of live video conferencing not only increases interaction between the instructor and students, but also gives real time attention to remote students. Basbay (2014) posited that interaction with other improves students awareness and helps the develop respect and appreciation for individual differences. Video conference can increase the opportunity for exchange of academic experiences by connecting students of different races and ethnicities without the need to leave their homes, and one of the video conferencing platforms id google hangouts.

Google Hangouts is one of the video conferencing systems available through Google Plus (Duffy, 2013). Some educators have integrated it into online and hybrid classrooms (Isaacson, 2013; Roseth, Akcaoglu, & Zellner, 2013). Google Hangouts is similar to Skype, as it provides a free audio/video conference along with a text chat capability. Both programs offer a free mobile app, making it easy for iPad, iPhone, or Android users to access the programs. However, Google Hangouts also has other unique features. Unlike Skype, Google Hangouts is free for a group conference. Anyone who has Google Plus accounts can join the group conference. Video conferencing on Google Hangouts can be recorded and uploaded to YouTube for sharing. The user can decide whether to share video conferencing publicly or only with friends. In addition, Google Hangouts also allows screen captures, screen shares, and remote desktop control, allowing users to control a computer monitor from the other end of the room during the video conferencing (Google Inc., 2013).

In selecting an appropriate video conferencing system, instructors should consider various factors. The system should be affordable, easy for students to use, and useful for enhancing instructional effectiveness and students' learning in mathematics. Although technology experts can provide reviews of new software and programs and help us learn their functionalities, instructors should also listen to student concerns so that they can adopt the technologies effectively to support students learning, Google Hangouts is a relatively new system and has not been used widely in educational settings. Another crucial video conferencing application in educational sector that will also be considered in this research is Zoom application.

Zoom application has appeared to be the most popularly used Video Broadcasting Tool (VBT) in the teaching and learning of Mathematics courses in Nigeria schools following the outbreak of COVID-19. Mathematics has become imperative in every society if the citizen are to cope with the fast changing development in science and technology. Mathematics embraces many important ideas about numbers and space. It also involves problem solving activities and it is a very powerful means of communication that is, the science or practice of transmitting information into symbols and signs (Krainer, 2011). Okigbo and Ugwu (2012) emphasized the importance of Mathematical knowledge as the science that deals with the

logic of shape, quantity and arrangement. Mathematics is all around us, in everything we do. It is the building block for everything in our daily lives, including mobile devices, architecture, art, money, engineering and even sports. Therefore there is need to bridge the gap that exists in the students' background in logic and reasoning, inequalities and statistics aspect of mathematics through the use of Zoom application.

Zoom application is an American communications Technology Company headquartered in San Jose, California that provides video telephone and online chat services through a cloud-based peer-to-peer software platform and is used for teleconferencing, telecommuting, full-time education, part-time education, distance education, and social relations. It is an open source as it is readily available for use on the market (UNESCO Institute for Statistics, 2020). Among other factors, many could have chosen the Zoom application because it has now become the leader in educational sector and modern enterprise video and audio communications, with an easy, reliable cloud platform for video and audio conferencing, chat and webinars across mobile, desk, and room system (UNESCO Institute for Statistics, 2020).

Besides, Zoom application provides a learning environment that is social-constructivist in nature, and as well provides instructors to plan and designate appropriate activities for the students on time, and it integrates a wide range of resources and assessment strategies (UNESCO Institute for Statistics, 2020).

Another compelling reason of choosing Zoom application is that it allows students and teachers to share the whiteboard that can be used to solve, writes the notes, and draw or illustrate mathematical problems; ask questions during the teaching and learning process by raising the hand; and share the screen to broadcast the notes (UNESCO Institute for Statistics, 2020). In addition, ZOOM app allows students and teachers to add participants, mute participants in case of noise distortion, and upload lecture notes during the teaching and learning process amidst COVID-19 pandemic (UNESCO Institute for Statistics, 2020). From the foregoing, it is of no doubt that Zoom application has become an increasingly important part of our academic systems in education sectors in Nigeria in order to strengthening students' academic achievement and retention in mathematics.

Academic achievement is viewed as learning outcomes of students of mathematics students in secondary schools (Ogundokun & Adeyemo, 2010). Despite the importance attached to mathematics in secondary school curriculum and the fact that several studies have proven that video conferencing enhance students' learning outcomes, only few teachers of mathematics try to employ it for the benefit of enhancing students learning outcomes especially at this time when teaching and learning are experiencing serious restructuring to stand the test of time. Some mathematics teachers are still holding unto the conventional method of teaching which is not adequate enough in enhancing the leaning needs of students in mathematics in this contemporary times. This has been affecting students' achievement in the subject especially in secondary schools and must be addressed properly, so that retention of mathematics knowledge will be enhanced.

Retention of mathematics takes place when learning is coded into memory, and appropriate coding of incoming information provides the index that may be consulted so that retention takes place without an elaborate search in the memory lane (Achor, Otor, & Umoru, 2013). Anything that aids learning improves retention while things that lead to confusion or interference among learned materials decrease the speed and efficiency of learning and accelerates forgetting.

Zoom application and Google hang out makes mathematics students to be actively involved in the teaching and learning process in order to improve achievement and retention of mathematics students through their behavior in manipulating Zoom and Google hang out in learning mathematics. According to Miltenberger (2001) behaviour is what people say or do, the theory of behaviourism concentrates on the study of overt behavior that

can be observed and measured. It views the mind as a black box in the sense that response to stimulus can be observed quantitatively, totally ignoring the possibility of thought process occurring in the mind. Behaviourists believe that all theories should have observable processes such as actions. For them, only overt behavior should be studied and recorded because inner states like motives or mental state cannot be measures objectively.

From the previous studies carried out on zoom application and google hangouts by Nurwati, Asdar, Nasrullah, Djadir and Mifta (2021) on effect of implementing online learning with the Zoom platform on students' learning outcome. The results of inferential statistical analysis show that students' average score after online learning using Zoom is greater. Abdulmoneim (2018) who investigates effect of using some google educational applications in teaching computer curriculum on the achievement of students for the first year in College of Education, University of Samarra. It was revealed that there are statistically significant differences at the level of significance (0.05) between the mean scores of the experimental group and the scores of the control group students in the post-achievement test for the experimental group studied using some Google educational applications. Jimoh, Shahid, Ibrahim and Usman (2020) who carried out study on effects of video instructional types on retention and achievement level of senior secondary school students in mathematics in Minna, Niger state. It was revealed that there was significant difference in the mean retention scores of students taught mathematics using Text Animation and narration, Text and Animation, Text and Narration and Text Only video instructional types. Therefore, the presents study aims at investigating the effect of Google hangouts and Zoom applicationon achievement and retention of mathematics students in private schools in Minna, Nigeria.

Statement of the Research Problem

Despite the importance of mathematics to individual and national development, studies have shown that students' achievement has been below expectation (Singh, 201I). This was discovered by the researchers from the previous Mathematics WAEC results of 2017 to 2020 which was compiled by Niger State Ministry of Education, Research and Statistics Unit.

Peter (2011) asserted that "the issue of poor achievement in mathematics examination was due to the problem of conventional method which is a classroom-based method characterized by teaching and instructions by teachers which make it to be a teacher-centered method of instruction. This method makes students to become passive rather than active learners. However, various efforts have been made by researchers and educators to come up with instructional strategies that will promote effective teaching and learning of mathematics concept as well as improve students' achievement but much has not been done in the area of supplementing conventional method with Google hangouts and Zoom application platform in secondary schools in Minna, Niger State, specifically on the effect of Google hangouts and Zoom application on the academic achievement of mathematics students. Therefore, it is necessary to look into the current method of teaching mathematics in order to get a suitable strategy that will lead to effective teaching and learning. Thus this study aims at investigating the effect of Google hangouts and zoom applications on achievement and retention of mathematics students in private schools in Minna, Nigeria.

Objectives of the Study

This study investigated the effect of Google hangouts and Zoom application on achievement and retention of mathematics students in private schools in Minna, Nigeria. Specifically, the study sought to:

1 Determine the mean scores of Google hangout, Zoom application, and Conventional method on students' academic achievement in Senior Secondary School Mathematics.

2 Find out the mean scores of Google hangouts, Zoom application and Conventional method on students' retention in Senior Secondary School Mathematics.

Research Questions

The following research questions were raised to guide the study:

1. What is the mean scores of Google hangout, Zoom application, and Conventional method on students' academic achievement in Senior Secondary School Mathematics?
2. What is the mean scores of Google hangouts, Zoom application and Conventional method on students' retention in Senior Secondary School Mathematics?

Research Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance:

H_{01}: There is no significant difference in the mean achievement scores of Google hangout, Zoom application, and Conventional method on students' academic achievement in Senior Secondary School Mathematics.

H_{02}: There is no significant difference in the mean retention scores of Google hangout, Zoom application and Conventional method on students' academic achievement in Senior Secondary School Mathematics.

METHODOLOGY

The research adopted the pre-test post-test randomized experimental research design. The population of the study comprises all senior secondary school mathematics students in private schools in Minna, Nigeria and the target population was SS II 4571 mathematics students. Multi-stage sampling technique was used to arrive at the sample for the study. Firstly was to cluster all the private schools into three cluster based on their location, Secondly one school was randomly selected in each cluster making three schools for the main study. Lastly randomly sampling technique was used to select 171 students (93 male and 78 female) from three schools namely Himma International School Minna, El-Amin International School and Ideal Royal School Minna respectively. The three schools were assigned to experimental group one, two and control group respectively. The Instruments for the study is Mathematics Achievement Test (MAT) that comprised of 30 multiple choice objective questions on the following topics; logic and reasoning, linear inequalities and statistics while treatment materials were Google Hangouts and Zoom Application. Also Google Hangouts and Zoom Application comprises of mathematics instruction presented online to the students on the following topics; logic and reasoning, linear inequalities and statistics. The Mathematics Achievement Test (MAT) was validated by three experts in Mathematics Education and Cyber Security at Federal University of Technology Minna, and Computer Science at El-Amin International School Minna. A pilot study was carried out to test the reliability of the research instrument using split-half method, and a reliability coefficient of 0.85 was obtained using Pearson product-moment correlation coefficient (PPMC). All the experimental and control groups were given Pretest before the treatment that lasted for two weeks on online teaching of mathematics using Google Hangout and Zoom Application. After the treatment, posttest was administered immediately on the groups while retention test was given to them two weeks after the posttest. Experimental procedure; Experimental group one was exposed to Google Hangout Mathematics Instruction Lesson, Experimental group two was exposed to Zoom application Mathematics Instruction Lesson while control group was exposed to Conventional Teaching Method. The retention test was administered on the groups after two weeks posttest was administered. Mean and standard deviation were used to analyze research questions while analysis of variance (ANOVA) was used to analyze research hypotheses.

RESULTS

Research Question One: What is the mean scores of Google hangout, Zoom App and conventional method on students' academic achievement in Senior Secondary Schools Mathematics?

Table 1: Mean and Standard Deviation of Pretest and Posttest Scores of Experimental and Control Group

Group	N	Pretest		Posttest		Mean Gain
		X	SD	X	SD	
Google hangouts	48	23.95	7.68	75.26	7.09	51.31
Zoom App	77	22.92	8.00	70.03	8.90	47.11
Conventional	46	22.66	9.16	42.98	6.94	20.32

Source: Authors

Table 1 showed the mean and standard deviation of achievement scores of experimental group one, experimental group two and control group in pretest and posttest. The result revealed that mean and standard deviation scores of the pretest and posttest experimental group one are $\bar{X}$ =23.95, SD = 7.68 and $\bar{X}$ = 75.26, SD = 7.09 respectively. This gives a mean gain of 51.31 for of Google hangouts group. Similarly, the mean and standard deviation of the pretest and posttest of the experimental group two are $\bar{X}$ = 22.92, SD= 8.00 and $\bar{X}$ = 70.03, SD = 8.90 respectively. This give a mean gain of 47.11 for the Zoom App group. On the other hand, the mean and standard deviation of the pretest and posttest of the control group are $\bar{X}$ = 22.66, SD = 9.16 and $\bar{X}$ =42.98, SD = 6.94 respectively, and gives a mean score of 20.32 for the conventional method. The results revealed that experimental group one, two and control group had mean gain of 51.31, 47.11 and 20.32 respectively with the experimental group one (Google hangouts) having the higher mean gain than Zoom App which in turn has higher mean gain than conventional method.

*Research Question Two***:** What is the mean scores of Google hangout, Zoom App and conventional method on students' retention in Senior Secondary School Mathematics?

Table 2: Mean and Standard Deviation of Posttest and Retention test Scores of Experimental and Control Group

Group	N	Posttest		Retention		Mean Gain
		X	SD	X	SD	
Google hangouts	48	75.26	7.09	79.27	9.57	4.01
Zoom App	77	70.03	8.90	74.67	11.52	4.64
Conventional	46	42.98	6.94	43.47	8.00	0.49

Source: Authors

Table 2 showed the mean and standard deviation of retention scores of experimental group one, experimental group two and control group in posttest and retention test. The result revealed that mean and standard deviation scores of the posttest and retention test of experimental group one (Google hangouts) are $\bar{X}$=75.26, SD = 7.09 and $\bar{X}$ = 79.27, SD = 9.57 respectively. This gives a mean gain of 4.01 for Google hangouts group. Similarly, the mean and standard deviation of the posttest and retention test of the experimental group two Zoom App are $\bar{X}$ = 70.03, SD = 8.90 and $\bar{X}$ = 74.67, SD = 11.52 respectively. This gives a mean gain of 4.64 for the Zoom App. On the other hand, the mean and standard deviation of the posttest test and retention test of the control group are $\bar{X}$ = 42.98, SD = 6.94 and $\bar{X}$ = 43.47, SD = 8.00 respectively and gives a mean gain score of 0.49 for the conventional method group. The result also revealed that experimental group one (Google hangout), two (Zoom App) and control group had mean gain of 4.01, 4.64 and 0.49 respectively, and with the experimental group two (Zoom App) having the highest mean gain of 4.64.

Hypothesis One: There is no significant difference in the mean achievement scores of

Google hangout, Zoom Application and conventional method on student's academic achievement in Senior Secondary School Mathematics

Table 3: summary of analysis of variance (ANOVA) comparison of the post-test mean Achievement Scores of the Experimental and Control Group Taught Mathematics using Google hangout, Zoom Application and Conventional Method

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	29186.674	2	14593.337	232.01	.000
Within Groups	10566.908	168	62.898		
Total	39753.582	170			

Source: Authors

Table 3 showed the results of the analysis of variance on achievement scores of students who were taught mathematics using Google hangout, Zoom App and conventional method. As shown in (Table 3) revealed F (2, 168) = 232.01 p=0.00. With P< 0.05, the null hypothesis ($\mathbf{H_{O1}}$) was rejected. Therefore, there is significant difference in the mean achievement scores of students taught mathematics using Google hangout, Zoom App and conventional method.

Hypothesis Two: There is no significance difference in the mean retention scores of Google hangout, Zoom Application and conventional method on student's academic achievement in Senior Secondary School Mathematics.

Table 4: summary of analysis of variance (ANOVA) comparison of the post-test mean Retention Scores of the Experimental and Control Group Taught Mathematics using Google hangout, Zoom App and Conventional Method

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	37157.996	2	18578.998	180.57	.000
Within Groups	17284.841	168	102.886		
Total	54442.836	170			

Source: Authors

Table 4 showed the results of the analysis of variance on retention of students who were taught mathematics using Google hangout, Zoom App and conventional method. As shown in (Table 4) revealed F (2, 168) = 180.57 p=0.00. With P< 0.05, the null hypothesis ($\mathbf{H_{O2}}$) was rejected. Therefore, there was significant difference in the mean retention scores of students taught mathematics using Google hangout, Zoom App and conventional method.

Discussion of Results

The result of testing research hypothesis one proved there was significant difference in the mean achievement scores of students' taught mathematics using Google hangout, Zoom App and conventional method. Therefore, hypothesis one was rejected. The results revealed that treatment had a significant effect on mathematics students' achievement. The findings revealed that Google hangout and Zoom application, was more effective than conventional method in the learning of mathematics. The effectiveness of the treatment strategies was due to the fact that it engaged and support secondary school students in taking control of their learning process. This is in support of the findings of Nurwati, Asdar, Nasrullah, Djadir and Mifta (2021) who carried out study on effect of implementing online learning with the Zoom platform on students'

learning outcomes. The results of inferential statistical analysis show that students' average score after online learning using Zoom application is greater. Also in agreement with the findings of Abdulmonein (2018) who investigates effect of using some google educational applications in teaching computer curriculum on the achievement of students for the first year in College of Education, University of Samarra. It was revealed that there was statistical significant differences at the scores of the experimental group and the scores of control group students in the post-achievement test for the experimental group studied using some Google educational applications in favour of Google educational applications. This is contrary to the findings of Miller and Joshua (2017)who found that there was no statistically significant difference in the academic achievement between the control and treatment groups from the pre-test to the post-test when used mobile learning as instructional delivery.

The result of testing hypothesis two shows there was significant difference in the mean retention scores of students taught mathematics using Google hangout, Zoom application and Conventional Method. Therefore, hypothesis two was rejected. The findings revealed that treatment had a significant effect on mathematics students' retention. The findings also revealed Google hangout, Zoom application was more effective than conventional method in the retention of mathematics. The effectiveness of the treatment strategies was due to the fact that secondary school mathematics students can access mathematics instruction repeatedly on the platforms. This is in agreement with findings of Jimoh, Shahid, Ibrahim and Usman (2020) who revealed that there was significant difference in the mean retention scoes of students taught mathematics using Text Animation and narration, Text and Animation, Text and Narration and Text Only video instructional types.

CONCLUSION

Based on the findings of this study therefore, it was proven that Google hangouts and Zoom Application was found to improve students' achievement and retention in mathematics as compared with the conventional method. It was also establish that Google hangouts and Zoom application can serve as learning platform that can encourage collaborative learning in mathematics.

Recommendation

1. Mathematics teachers should employ the use of Google hangouts and Zoom application learning platform in order to enhance achievement and retention of learners.
2. Teachers teaching mathematics subject should expose the students to Google hangouts and Zoom application learning platform in order to promote student-centered instructional approach, and student-self-discovery learning.
3. Workshops, seminars and conferences should be organized by private school board, non- governmental organizations and institutional authorities to equip teachers with the needed skills for online learning.

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