



Effect of Google Classroom on Secondary School Students' Engagement and Achievement in Mathematics

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Abstract

The study investigates the effect of google classroom on secondary school students' engagement and achievement in mathematics. Two research questions and two hypotheses guided the study which adopted pretest posttest non-equivalent group quasi-experimental design. The sample comprised 67 SS2 students in two intact classes drawn using purposive sampling technique. Data were gathered using 'Students' Learning Engagement Questionnaire' (SLEQ) and 'Mathematics Achievement Test' (MAT) whose reliability indices were 0.76 and 0.74 obtained using Cronbach Alpha and Kuder-Richardson20 methods respectively. Mean and standard deviation were used to answer the research questions while ANCOVA was used to test the hypotheses at .05 level of significance. Results showed that face-to-face method had a significantly positive effect on students' engagement in mathematics than google classroom while google classroom had a significant positive effect on students' achievement in Mathematics than face-to face. It was recommended that google classroom should be used in the teaching mathematics in schools.

Keywords: Google classroom, Students; Engagement, Achievement, Mathematics

Introduction

The occurrence of the novel corona virus disease (COVID) in Wuhan China in 2019 had an immediate impact on the world. Nearly all aspects of human activities including education were affected. The disease spread so fast that it was immediately declared a pandemic by the world health organization (WHO). Due to the speed with which it was spreading, there was little or no time to produce drugs nor vaccines to tackle it. Hence, the WHO (2019) recommended non-pharmaceutical measures such as social and physical distance among others to curb its spread. This means that activities that requires large gathering of people such as schools and markets were stopped or social and physical distancing maintained. Thus, it became very difficult for schools to operate under such strict conditions. As such governments in many countries closed down schools (United Nation Education, Scientific and Cultural organization (UNESCO) (2020).

However, is was still necessary for students to continue learning amidst the pandemic. This issue emphasizes the importance of digital learning in ensuring learning continuity and protecting students' educational rights. So, many countries of the world such as China, Bulgaria, Finland, the USA, Britain and Nigeria among others recommended a migration from the traditional face-to-face teaching and learning to online learning (Patrick, Nnadi, Ukwueze & Aneshie-Otakpa, 2021). According to Senad (2021), online

learning became an option for schools as substitute to classroom teaching. Online learning is defined by Oguguo, Ocheni and Adebayo (2021) as the process of employing technology to give education and training applications electronically, observe learners' performances, and provide feedback on learners' progress.

One of the recent additions to virtual and online learning platforms is the Google classroom. Google Classroom is a new component in Google Apps for Education that was introduced in 2014. This classroom allows teachers to easily create and manage assignments, provide timely feedback, and communicate with their students (Shaharane, Jamil & Rodzi, 2018). According to Abidin and Saputro (2020), Google classroom is a useful tool for supporting learning activities because of its flexibility and numerous feature. Google classroom has features that can be used in the learning process like class preparation, display student assignments, storing data on Google Drive and developing learning material, namely creating questions, creating assignments, and creating topics will be discussed in virtual classes (Ulum, 2020). Teachers can use Google Classroom to give online assignments, promote collaboration among their colleagues, students, and students, and maintain constant communication with students. Furthermore, teachers can establish virtual courses, offer tasks, send feedback, and view all of this information in one place.



Google Classroom features communication and discussion tools such as online debates, forums, reviews, brief messages, and emails, allowing students to engage in collaborative learning which can be used for teaching and learning of mathematics. Besides, Google classroom may be considered one of the inquiry-based learning media since it can fully engage students' talents in finding, understanding, exploring, analyzing, and formulating learning outcomes (Ghofur, 2018).

By this, it helps the students to find out information for themselves which may help increase their level of learning engagement and consequently achievement in school subjects like mathematics. Learning engagement was described by Wiseman, Kennedy and Lodge (2016) as students' active participation or conscious investment of effort in their educational activities. Students' engagement, according to Bender (2017), is defined as students' cognitive investment in, active participation in, and emotional commitment to learning specific information. In the present study, learning engagement is defined as the extent to which students participate in a teaching and learning activities. When students are actively engaged in an activity, it is most likely that they could gain useful insights and knowledge on how to solve problems for themselves. This in turn may enhance their academic achievement in mathematics.

Students' academic achievement has been a major source of concern to educationist and researchers. Academic achievement according to Steinmayr, Meibner, Weidinger and Wirthwein (2015) is the performance outcomes which shows the extent individuals, students, teachers and the school have accomplished specific goals that were the focus of instruction especially in school settings. Academic achievement involves what a student had achieved in several disciplines during the course of their career which includes progress in core academic subjects such as mathematics, science, language, arts, and social studies and performance in areas such as athletics, music and art among others (Andortan, Ubebe & Aneshie-Otakpa, 2022). The above definitions imply that academic achievement covers all aspects of what a student is expected to cover during the course of schooling. This may reflect why much attention is paid on students' achievement. Despite the importance of high students' achievement in mathematics and school subjects generally, the problem of mass failure across the different levels of education is a common knowledge (Afolabi, Wakili, Afolabi, Onwuegbunam

& Ademuwagun, 2020). This has been attributed to many factors including teaching methods and as such researchers are interested in findings methods that may be effective in improving students' achievement especially post COVID 19 era. One of such methods the present researchers feel could be efficient in promoting student's achievement and engagement is the google classroom. This is because google classroom makes learning student-centered, motivated, tcreative and improve problem-solving skills (Cook & Sonnenberg, 2014). It is imperative for the present study to investigate the effect of google classroom on students' engagement and achievement in mathematics.

Literature evidence revealed that google classroom and other online learning platforms may be effective in improving students' interest, participation and achievement in school subjects including mathematics. For example, Cacace (2019) revealed that student achievement did not show much improvement and that students were not very passionate about using Google Classroom to complete assignments but preferred it for keeping track of assignments. However, Oyarinde and Komolafe (2020) showed that Google classroom platform positively affected students' academic achievement, attitudes and their perception. Another study by Senad (2021) revealed that students have positive perceptions on using Google Classroom in mathematics. More so, Sari and Yin (2021) revealed that the group of students who were exposed to the google classroom using collaborative approach showed a better interest in economics learning than the group of students who were not exposed to it. In a similar vein, Sri Sasmita, Redhana and Suja (2021) revealed that students' learning achievement taught by online learning of the Google Classroom was better than that of the WhatsApp group.

The above literature shows that the result of the effect of google classroom on students' engagement and achievement is mixed and contradictory. More so, in the case of mathematics, there were fears that learning mathematics outside of the classroom could impede students' engagement to learning mathematics in a variety of ways. This is due to the fact that face-to-face learning may allow students to learn from one another's tactics (Russo & Hopkins, 2017). A synchronous in-class facilitator is likely to be required for such a discourse-intensive approach to learning mathematics. Also, mathematics is a practical subject that requires active participation of students on activities. The teacher in the face-to-face learning situation may be able to assign activities to students and follow up such

activities to a reasonable conclusion. Furthermore, teachers may anticipate or respond to negative attitudes toward mathematics and mathematics learning held by some students (Clarke, Roche, Cheeseman, & Sullivan, 2014). This means that more research is required on the effect of google classroom on students' learning outcomes so as to inform policies and programmes that may lead to the digital switch from face-to-face learning to google classroom. Based on the problem of the study, the study investigated the effect of google classroom on secondary school students' engagement and achievement in mathematics.

In line with the purpose of the study, the following research questions guided the study

1. What is the mean engagement scores of students taught mathematics using google classroom and those taught using face-to-face method?
2. What is the mean achievement scores of students taught mathematics using google classroom and those taught using face-to-face method?

The following hypotheses were also tested at 0.05 level of significance in line with the research questions

1. There is no significant difference in the mean engagement scores of students taught mathematics using google classroom and those taught using face-to-face method
2. There is no significant difference in the mean achievement scores of students taught mathematics using google classroom and those taught using face-to-face method

Method

A non-equivalent control group, pretest and posttest quasi-experimental research design was adopted in the study. The study was conducted in Calabar municipal, Cross River State, Nigeria. The study area was used because it has schools with facilities that could facilitate the conduct of the study in the area. Besides, the area has students with iPad and laptops that could be used for google classrooms. The population of the study consisted 4 528 SS11 students in 24 private secondary schools in the area for 2021/2022 academic session. Two schools were sample using purposive sampling technique were two intact classes were drawn using simple random sampling technique. The sample of the study was 67 students. To avoid disrupting the schools' usual teaching and learning operations, intact

classrooms were employed. The two intact classrooms were divided into two groups, one for google classroom (experimental) and the other for face-to-face method (control). There were 31 pupils in the experimental group and 36 in the control group.

Two instruments titled; Students' Learning Engagement Questionnaire (SLEQ) and Mathematics Achievement Test (MAT) developed by the researchers were used for data collection. The SLEQ consisted of 20 items that elicited data on students' learning engagement in mathematics. The ratings for each were on a four-point scale of strongly agree (SA), agree (A), disagree (D) and strongly disagree (SD) respectively. The MAT contained 20 dichotomously scored multiple choice items with four response options of A, B, C and D that elicited data with respect to students' achievement in mathematics. Students' achievement was drawn using Bloom's taxonomy of educational objectives. The test covered Geometry because this topics one of the areas of mathematics in which students continue to perform poorly (WAEC, 2019). The SLEQ and MAT together with the lesson plans for the experimental and the control groups were faced validated by three experts. Two of the experts are from Mathematics Education Unit while the third expert is from Measurement and Evaluation programme area, Department of Science Education, University of Nigeria, Nsukka. The SLEQ and MAT were later trial tested on 20 SS2 students in a school that was not part of the study. Cronbach alpha method was used to establish the reliability coefficient of the SLEQ because the items were polytomously scaled. The reliability coefficient obtained was 0.76. The reliability coefficient of the MAT was established using Kuder-Richardson 20 method because the items were dichotomously scored and the reliability coefficient obtained was 0.74.

Presentation

Before the commencement of the study, the researchers visited the sampled schools to seek permission from the school principals to use their schools and students for the study. After permission was granted, the researchers recruited the services of two regular mathematics teachers (one from each intact class) as research assistants. The reasons for using regular mathematics teachers was to ensure that the students are not aware they were involved in an experiment. The research assistants were very well informed about the objective of the research. The research assistant for the experimental group was trained for four days on the use

of google classroom while the one of the control group was asked to use the traditional face-to-face lecture method.

The experiment lasted for a period of five weeks. In the first week, the research assistants were trained for four days. The instruments were administered on both groups on the fifth day as pretest. The normal lesson periods on the school’s timetables were used to conduct the experiment which lasted for 40 minutes per lesson for four times a week. The control group were taught in the class while the experimental group were taught in a computer laboratory where Google Apps for Education (GAPE) was downloaded into the computers and the teacher makes an online class for physical classes using programmes such as Google Docs, Google Forms and Google Presentation. There was one teacher computer that was connected to an overhead projector and interactive Smart Board from where the teachers create virtual classes, distribute assignments, send feedback, and see everything within one media. Two sets of lesson plan, with the same

content, specific objectives, duration and evaluation were developed for the two groups, except that the lesson plan for the experimental group was electronically prepared for online learning with google classroom app while that for the control group was prepared for lecture method. At the fifth week, items in the same SLEQ and the MAT were reshuffled and re-administered to the students as posttest in order to determine the effect of the treatments on the students’ engagement and achievement in mathematics. The students in both groups manually rated the SLEQ and manually answered questions in the MAT and were scored by the teachers. Each correct option in the MAT was scored one point whereas each wrong option attracted zero point. Data collected were analyzed using mean and standard deviations to answer the research questions while the null hypotheses were tested using analysis of covariance (ANCOVA) at 0.05 level of significance.

Results

Table1: Mean and Standard deviation of mean engagement scores of students taught mathematics using google classroom and those taught using face-to-face method.

Groups	N	Pretest		Posttest		Mean Difference
		\bar{x}	SD	\bar{x}	SD	
Experimental (google classroom)	31	48.77	8.04	59.97	7.02	11.20
Control (face-to-face method)	36	47.27	3.66	61.86	6.08	14.59

Result in Table 1 shows that the mean differences of 11.20 and 14.59 for the experimental and control groups respectively depicts that face-to-face teaching method

had positive effect on students’ engagement in mathematics than google classroom.

Table 2: Analysis of Covariance (ANCOVA) of the effect of google classroom on students’ engagement in mathematics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	Dec.
Corrected Model	164.561 ^a	2	82.280	1.972	.148	.058	
Intercept	2671.039	1	2671.039	64.015	.000	.500	
pretest1	104.849	1	104.849	2.513	.118	.038	
Groups	79.767	1	79.767	1.912	.172	.029	NS
Error	2670.424	64	41.725				
Total	252020.000	67					
Corrected Total	2834.985	66					

a. R Squared = .058 (Adjusted R Squared = .029)

The result in Table 2 shows that the effect of google classroom on students’ engagement in mathematics was not significant ($F(1, 66) = 1.92, p > .05, \eta^2p = .029$), thus the hypothesis is not rejected . This is because the exact probability value of 0.172 is greater than 0.05 set as level of significance. The effect size of ($\eta^2 p = .029$),

moreover, indicates that 2.9percent changes in students’ engagement in mathematics is due to the use of google classroom. Thus, inference drawn is that google classroom has no significantly positive effect on students’ engagement in mathematics

Table3: Mean and Standard deviation of mean achievement scores of students taught mathematics using google classroom and those taught using face-to-face method.

Groups	N	Pretest		Posttest		Mean Difference
		\bar{x}	SD	\bar{x}	SD	
Experimental (google classroom)	31	10.00	1.71	14.35	2.56	4.35
Control (face-to-face method)	36	9.53	1.55	11.61	2.01	2.08

Result in Table 3 shows that the mean differences of 4.35 and 2.08 for the experimental and control groups respectively depicts that google classroom had positive effect on students’ achievement in mathematics than face-to-face method.

Table 4: Analysis of Covariance (ANCOVA) of the effect of google classroom on students’ achievement in mathematics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared	Dec.
Corrected Model	134.823 ^a	2	67.412	13.065	.000	.290	
Intercept	202.340	1	202.340	39.215	.000	.380	
pretest2	9.431	1	9.431	1.828	.181	.028	
Groups	113.088	1	113.088	21.918	.000	.255	S
Error	330.222	64	5.160				
Total	11581.000	67					
Corrected Total	465.045	66					

a. R Squared = .290 (Adjusted R Squared = .268)

The result in Table 4 shows that the effect of google classroom on students’ achievement in mathematics was not significant ($F(1, 66) = 21.918, p < .05, \eta^2p = .255$), thus the hypothesis is rejected . This is because the exact probability value of 0.00 is less than 0.05 set as level of significance. The effect size of ($\eta^2 p = .255$), moreover, indicates that 25.5 percent changes in students’ achievement in mathematics is due to the use of google classroom. Thus, inference drawn is that google classroom has a significantly positive effect on students’ achievement in mathematics.

Discussion

The findings of the study revealed that the face-to-face method had a positive effect on students’ engagement in mathematics than the google classroom. However, the effect was small and not significant. This means that the face-to-face method is better in engaging the students in mathematics activities than the google classroom. The above findings are in line with previous findings by Cacace (2019) who indicated that students were not very passionate about using Google Classroom to complete assignments but preferred it for keeping track of assignments. These findings may be true because in the face-to-face classroom setting, students meet one another, collaborate and share ideas while

engaged in class activities. More so, the teacher has the leisure of interacting with the students direct and getting them involved actively in the teaching and learning process.

Furthermore, the findings of the study revealed that the google classroom had a significant positive effect on students’ achievement in mathematics. This implies that students’ achievement in mathematics would improve if taught using google classroom. The above findings corroborate previous findings by Oyarinde and Komolafe (2020) and Sri Sasmita, Redhana and Suja (2021) who in their separate studies revealed that the Google classroom platform positively affected students’ academic achievement, attitudes and their perception during the pandemic in Nigeria’s secondary school. The above findings is true because young students enjoy teaching platform that are technologically driven. Therefore, the use of google classroom may be captivating and interesting to the students who may enjoy the lesson because of its technological nature. By being interested, students may become more actively engross in the teaching and learning of mathematics. This may help in their retention of concepts taught and which would culminate to an improvement in their achievement.



Conclusion

There is always the need to find alternative teaching methods that could be used for teaching and learning in times of pandemics. Based on this, the present study investigated the effect of google classroom on secondary school students' engagement and achievement in mathematics. Based on the findings of the study, it was concluded that the face-to-face method is more effective in enhancing students' engagement than the google classroom. It was further concluded that the google classroom has a significant positive effect on students' achievement in mathematics. The findings provided information on the effectiveness on google classroom on students' achievement in mathematics.

Recommendations

Based on the findings of the study, the researchers recommended that

1. Google classroom should be used in teaching mathematics in schools
2. Government should provide facilities in public schools that enhance the use of google classrooms in teaching.

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