Google Classroom Blended Learning Strategy and Secondary School Chemistry Students' Performance in Obio-Akpor LGA, Rivers State

Dr Ugonwa Rosemary C.
Email: rosemaryugonwa@uniport.edu.ng

Abstract

This study examined the use of Google Classroom in Blended Chemistry Learning and Secondary School Chemistry Students' Performance in Obio-Akpor Local Government Area of Rivers state. Quasi-experimental design was adopted for the research. A sample size of fifty-one (51) senior secondary school III students participated in the study. Two research questions and two null hypotheses guided the study. A validated instrument titled Google Classroom Blended Learning Chemistry Performance Test (GCBLCPT) was used to collect data. The reliability of the instrument was established using split half method and correlated with Pearson Product Moment Correlation Coefficient and Spearman-Brown Correlation to obtain an index of +0.82. The research questions were answered using mean and standard deviation while the hypotheses were analyzed using ANCOVA at 0.05 significant level. Findings from the study revealed that the chemistry students who were taught with both the Google classroom and physical classroom made higher learning performance gain than those taught only in their traditional physical classroom. There was a significant effect of the use of Blended Google classroom over the physical classroom chemistry teaching-learning on the scores of the students. It was recommended among others that use of Google classroom should be adopted as a Blended learning technique in the teaching and learning of chemistry at the senior secondary school level to enhance learning and also improve the performance of the students in chemistry.

Keywords: Google, classroom, blending, virtual.

Introduction

The integration of technology into all fields, including education is rapidly becoming one of the most progressive and widely discussed issues in the present-day education policy. Indeed, the role of Information and Communication Technology (ICT) as a gateway to enlighten human's perception and creativeness cannot be overemphasized, especially in the teaching and learning of Chemistry and Science Education. Ugonwa and Nwanekezi (2018) opined that a good science education must be directed towards imbibing in the students the need for a thorough understanding of scientific concepts by means of technology. It was therefore necessary for education to take advantage of incorporating ICT in the teaching and learning process in all facets. Blending the teaching and learning of Chemistry within and outside the confines of the physical school or classroom environment will enhance learning, students' interest and familiarity with the subject, thereby demasking the presumed rigid abstract nature of Chemistry and improve their performance in the subject. According to Nwanekeazi and Ugonwa (2018), a teaching strategy which combines the use of ICT or e-learning and the traditional face-to-face classroom learning is known as blended learning.

The internet is known to play a key role in enhancing the effectiveness of teaching and learning at all levels, particularly with the emergence of e-learning and digital tools. Chemistry being one of the main science subjects learnt in schools and a major tool for projecting science and technology in Nigeria should be given a high precedence in the choice of the teaching methodology by employing the most effective and innovative strategies in its teaching and learning. Arokoyu and Ugonwa (2012), identified Chemistry as one of the major ingredients of technology. It is called the central science and it studies the various substances in the world with a particular focus on the processes by which one substance is transferred or converted into another, (Alan & Melvyn, 2021). Chemistry has been defined by Alan and Melvyn (2021) as the science that deals with the properties, composition and structure of substances, the transformation they undergo and the energy that is released or absorbed during the process. It is easy to underestimate the central role of Chemistry in modern society but chemical products are very essential if the world's population has to be fed, housed and clothed. The study of Chemistry has always been of inestimable value to humanity as it has the ability of explaining natural phenomena and plays very significant role in the world's technology development (Ugonwa & Ndioho, 2018). The positive impact of Chemistry on the society as a whole goes beyond doubt as it is evident in the medical, engineering, transport, food and health sectors (Arokoyu & Ugonwa, 2012). It therefore becomes very imperative to employ very efficient and effective innovative strategies in the teaching and learning of Chemistry from the secondary school up to the tertiary institutions level in order to enable both the teachers and students gain adequate knowledge and skills required in Chemistry for productivity and technological advancement.

One efficient way of enhancing teaching and learning of sciences is by adopting the use of blended learning. Blended learning is a formal education program in which students learn in parts through delivery of content and instruction using digital and online media, with some elements of student control over time, place, path or pace. Michael and Heather (2014) defined blended learning as combining e-learning with traditional classroom methods and independent study to create a new hybrid teaching methodology. It is generally practiced by using both online learning and physical classroom. It is practiced in a way that sometimes students may be asked to review their learning progress, discuss their work, ask questions or receive assistance with difficult concepts. The concept of blended learning as summarized in the Michael and Heather (2014) model include Rotation Model, Flex Model, A La Carte Model and Enriched Virtual Model. Out of these four blended learning models, the rotation model plays or significant ease of flexibility as it comprises four sub-models which are station rotation, lab rotation, flipped classroom and individual rotation models.

Use of ICT and internet being an innovative tool and efficient strategy for teaching and learning provides numerous learning opportunities and closes the gap and deficiencies that exist in teaching and learning process. Thus, the internet plays a major role in enhancing the effectiveness of teaching and learning at all levels, particularly with the emergence of e-learning and digital learning tools. Dike and Ugonwa (2021) stated that innovative technologies are participatory and easy to use and can be incorporated easily into the science classroom with other technologies for more efficient and interesting instruction. The internet and ICT has given rise to the emergence of new concepts such as

virtual classroom, e-courses, web-based learning and learning management systems, Shana, Alyatim, Alkhazaleh and AlShalabi (2021). The internet has obviously become a platform for not only information and knowledge creation but electronic educational media such that new platforms of participatory and interactive learning are made possible. Based on the affordances of the internet-based and e-learning program–applications, recommendations have been made by various institutions at scientific conference levels for educational institutions to pay attention to and embrace the modern technology and internet-based e-learning tools in the teaching and learning process. There is also increased interest in the use of digital technologies in teaching and learning overtime since the post Covid-19 era, due to their ability in helping the learners accomplish their learning tasks and also interact with the teachers regardless of place and time. Al-Raheely (2013) in Shana, et al. (2021) observed that such technologies have also changed the role of the teacher to guide, plan, direct, facilitate and coordinate the teaching and learning process. One of these digital technologies is the Google Apps for Education (GAFE) platform of cloud-based computing apps (Shana, et al., 2021). The Google Apps for Education platform is a group of online applications that give room for sharing and enhancing social presence in e-learning providing solutions for the use of technology in learning.

Google classroom is a typical example of these applications. It is one innovative educational apps that brings the teacher and the learners together in a virtual classroom with the purpose of connecting the class easily, trace the students' progress and accomplish learning tasks together. Kate (2021) defined the Google classroom as a platform that ties together Google workplace tools (formerly known as G-suite) for teachers and students. it can also be described as a digital organizer where teachers can keep class materials and share them with students, all paperless, from there you can pick and choose the features you want to incorporate. Google classroom enables flexibility and seamless integration with Google popular tools, thus making Google classroom one of the most widely used ed-tech tools today. Using the blended learning strategy in Chemistry, the station rotation and flipped classroom models of blended learning can be easily incorporated into the learning process using the Google classroom. While the students practice online learning outside the school or classroom, they still attend the brick-and-mortar school for face-to-face, teacher-guided practice and laboratory practicals. Lagofatu, Visan and Ungurenanu (2015), as cited in Shana et al. (2021), reported that Google app was tested by 100 thousand teachers from more than 45 countries who confirmed the effectiveness of the application in accomplishing the tasks and achieving the teaching and learning goals in its different components. For teachers and learners, Google classroom brings the benefit of paperless sharing, assessment and digital collaboration to classrooms. Google classroom can accommodate tens and millions of teachers and learners at the same time in Google meet, thus it is an education friendly platform. There are different ways in which educators can use the features of a Google classroom as identified by Kate (2021). The teachers can:

1. Streamline how they manage classes, using many built-in "shortcuts" like docs, drive, meet and calendars.

2. Digitally organize, distribute and collect assignments, course materials (e.g. videos, PDFs, websites) and students work.
3. Communicate with students about their classwork.
4. Give students timely feedback on their assignment and assessments.

Google classroom can help Chemistry teachers streamline summative and formative assessments for example, they can use the platform to quickly create and share classwork, quiz questions and get insights on the students' understanding. They can also give tests which can be multiple-choice, essay type and so on. Students also have options to upload files, charts or diagrams, when responding to questions, thus students can share their knowledge in a variety of ways. Google classroom can be used to teach live using the Google meet in form of video conferencing. Google meet integrates with Google classroom whereby teachers can set up video meetings from within the Google classroom for live (or synchronous) teaching and learning. There is also room for recording of the live video lessons in Google meets such that the pre-recorded video lessons can be assessed by the students at their own time and pace for asynchronous learning.

Taking into cognizance therefore the difficulty in meeting up with the coverage of Chemistry syllabus as it is in the secondary school curriculum and considering the inconsistencies in the Nigerian education and economic system lately, there is need to consider the teaching and learning of science-subjects, Chemistry in particular, using a blended learning approach to incorporate the use of Google classroom. This will make teaching and learning of Chemistry more realizable and cover more topics in the syllabus as well as improve the performance of the Chemistry students.

Aim and Objectives of the study

The aim of this study is to determine the effect of using Google classroom blended learning strategy on the performance of Chemistry students in Rivers State. Specifically, the objectives of the study are to;

(1) investigate the relative effect of the use of Google classroom blended learning strategy over the use of physical classroom only, in the mean performance scores of SS2 Chemistry students in chemistry.

(2) ascertain if differences exist in the mean performance scores of male and female SS2 Chemistry students who were taught Nitrogen and its compound, using Google classroom blended learning strategy.

Research Questions

The research questions that guided the study are:

(1) What is the mean performance score of SS2 Chemistry students taught with Google classroom and those taught in the physical classroom in Chemistry?

(2) What is the difference in the mean performance score of male and female SS2 Chemistry students taught using Google Classroom blended learning strategy?

Hypotheses:

(1) There is no significant difference between the mean performance test score of SS2 Chemistry students taught with Google classroom blended learning strategy and those taught only in the physical classroom.

(2) There is no significant difference between the mean performance score of SS2 male and female students taught using the Google classroom blended learning strategy.

Methodology

Research Design: The study used the quasi-experimental design; thus, intact classes were used for the research.

Structure of the Research design

Pre-test, Post-test Quasi-Experimental Design

Group	Pre-test	Treatment	Post-test
E	Q_1	X_{GC+Phy}	Q_2
	- -		
C	Q_1	X_{Phy}	Q_2

Where

E	=	Experimental group
C	=	Control group
Q_1	=	Pre-test
Q_2	=	Post-test
X_{GC+Phy}	=	Treatment to E
Xphy	=	Treatment to C
- - - - - - -	=	Intact Class

The population of this study comprises of 5,387 secondary school II (SS2) Chemistry students in the twenty senior secondary schools in Obio/Akpor Local Government Area of Rivers State (Rivers State Senior Secondary School Board 2022). Purposive sampling technique was used to select two co-educational secondary schools from the target population. In each of the schools selected, simple random sampling was used to select one arm which is an intact SS2 science class, to obtain a total of fifty-one (51) secondary school III students (28 males and 23 females) who participated in the study. One of the classes selected which has 23 SS2 students served as the experimental group while the other class of 28 SS2 students was used as the control group. The Chemistry topic used for the treatment in this study was Nitrogen and its Compounds. A 20 multiple-choice test item titled Google Classroom Blended Learning Chemistry Performance Test (GCBLCPT) was used for the study. The test items were based on the topic Nitrogen and its Compounds. 5 marks each were awarded for each question giving a total of 100 marks. The face and content validity of the instrument was determined by a senior Chemistry teacher and an expert in measurement and evaluation. Split-half method was used to establish the reliability of the instrument and Pearson Product Moment Correlation Co-efficient (PPMCC) in conjunction with Spearman-Brown Correlation applied to obtained a correlation of +0.82, showing that the instrument (GCBLCPT) was

reliable for the study. The data obtained were analyzed using mean, standard deviation and the Analysis of Covariance (ANCOVA) used to test the hypotheses at 0.05 level of significance.

Result

Research Question 1: What is the mean performance score of SS2 Chemistry students taught with Google classroom and those taught in the physical classroom in Chemistry?

To answer research question 1, the Pre-GCBLCPT and Post- GCBLCPT scores of students taught using Google classroom Blended Learning and that of those taught in physical classroom were subjected to descriptive statistics. The results obtained were presented in table 1.

Table 1: Mean and standard deviation on the performance score of SS2 Chemistry students taught with Google classroom BL and those taught in physical classroom.

Treatment	N	Pre-test Mean	SD	Post-test Mean	SD	Gain Mean	SD
Google classroom BL	23	32.61	6.82	72.82	9.24	40.21	10.25
Physical classroom	28	29.20	7.04	57.94	7.62	28.74	11.05

Pre-test mean score for Google Classroom Blended Learning was 32.61, SD = 6.82, post-test mean score was 72.82, SD = 9.24. Learning gain mean was 40.21, SD = 10.25. The pre-test mean score for physical classroom was 29.20, SD = 7.04, their post-test mean score was 57.94, SD = 7.62. Learning mean gain was 28.74, SD = 11.05.

Research Question 2: What is the difference in the mean performance score of male and female SS2 Chemistry students taught using Google Classroom blended learning strategy?

To answer research question 2, the Pre-GCBLCPT and Post-GCBLCPT scores of the male and female students taught using Google classroom Blended Learning were subjected to descriptive statistics. The results obtained were presented in table 2.

Table 2: Mean and standard deviation on the performance score of SS2 Chemistry students taught with Google Classroom BL, analyzed based on sex

Sex	n	Pre-test Mean	SD	Post-test Mean	SD	Gain Mean	SD
Male	15	32.50	7.65	72.95	6.82	40.45	8.35
Female	8	28.96	5.02	68.02	9.65	39.06	12.66

Pre-test mean score of the male students for Google Classroom Blended Learning was 32.50, SD = 7.65, post-test mean score was 72.95, SD = 6.82. The learning mean gain was 40.45, SD = 8.35. The pre-test mean score of the female students for Google classroom BL was 28.96, SD = 5.02, post-test

mean score was 68.02, SD = 9.65. Learning mean gain was 39.06, SD = 12.66. The difference in learning gain mean score of female over their male counterparts was 1.39.

H_{01}: There is no significant mean difference between mean performance test score of SS2 Chemistry students taught with Google Classroom Blended Learning and those taught with physical classroom only.

Table 3: Summary of ANCOVA on the mean difference between the mean performance score of SS2 Chemistry students taught with Google classroom Blended Learning and those taught with physical classroom.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2252.003[a]	2	1126.001	17.379	.000
Intercept	11151.962	1	11151.962	172.125	.000
Pre-test	28.336	1	28.336	.437	.512
Treatment	2214.206	1	2214.206	34.175	.000
Error	3109.919	48	64.790		
Total	218374.000	51			
Corrected Total	5361.922	50			

SS = Type III Sum of Squares, df = Degree of Freedom

Table 3 established that there is a significant mean difference between the mean performance score of SS2 Chemistry students taught with Google classroom Blended learning and those taught with physical classroom in Chemistry (F1, 48 = 34.175, p<.05.). The null hypothesis one was rejected at 0.05 alpha level.

H_{02}: There is no significant difference between the mean performance score of SS2 male and female students taught using the Google Classroom Blended Learning strategy.

Table 4: Summary of ANCOVA on the difference between the mean performance scores of male and female SS2 Chemistry students who were exposed to Google classroom BL

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	151.186b	2	75.593	1.032	.374
Intercept	4588.593	1	4588.593	62.658	.000
Pre-test	8.293	1	8.293	.113	.740
Treatment	120.290	1	120.290	1.643	.215
Error	1464.640	20	73.232		
Total	120560.000	23			
Corrected Total	1615.826	22			

SS = Type III Sum of Squares, df = Degree of Freedom

The result of the ANCOVA on table 4 implies that the male and female students taught using Google classroom Blended Learning showed no differences in their learning performance gain (F1, 20 = 1.643, p>.05). The null hypothesis two was retained at 0.05 alpha level.

Summary of Findings

S/N	Research questions and hypotheses	Highest learning gain	Decision
1	Rq1/h01	Google classroom bl	Sig., reject h01
2	Rq2/h02	Male	Not sig., retain h02

Discussion of Findings

The result from table 1 reveals that students taught using Google Classroom Blended Learning strategy performed better than those taught only in the physical classroom with mean learning achievement gain score of 11.47. Also, the Post-GCBLCPT mean score shows that students taught using the Google Classroom Blended Learning outperformed those taught with only physical classroom with a mean difference of 14.88. This implies that students taught using Google classroom blended learning strategy benefitted by the instructional delivery strategy when compared with those taught only in the physical classroom. The result of the ANCOVA on table 3 reveals that there was a significant main effect of the Google classroom blended learning strategy over physical classroom only on the learning performance of senior secondary students in chemistry (F1, 48=34.175, P<.05); thus, H_{o1} was rejected at 0.05 level of significance. This implies that students taught using the Google classroom blended learning strategy benefited more by their instructional exposure than those taught using the physical classroom only. This finding agrees with the opinion of Dike and Ugonwa (2021) which stated that innovative technologies are participatory and easy to use and can be incorporated easily into the science classroom with other technologies for more efficient instruction. It also agrees with the findings of Lagofatu, Visan and Ungurenanu (2015), as cited in Shana et al. (2021), who reported that the Google app which was tested by 100 thousand teachers from more than 45 countries confirmed the effectiveness of the application in accomplishing the tasks and achieving the teaching and learning goals in its different components.

The result from table 2 showed that there was no significant difference between the mean performance scores of male and female SS2 chemistry students who were taught with Google classroom blended learning strategy. The mean learning performance gain score was 1.39 and the mean difference in learning achievement of the female over their male counterpart in the Post-GCBLCPT mean score was 4.93. The result of the ANCOVA on table 4 established that the male and female students taught using Google classroom blended teaching and learning strategy showed no differences in their learning performance gain (F1, 20=1.643, p>.05). The H_{o4} was retained at the .05 level of significance. This implies that both male and female students gained from the treatment with Google classroom blended learning strategy in chemistry.

Conclusion

The findings from this study revealed that use of Google classroom in Blended chemistry learning strategy was highly efficient in enhancing the teaching and learning process and improving the performance of the chemistry students. The Google meet and the classroom engaged the students in the teaching-learning process and helped them to gain more understanding of the topic Nitrogen and its Compounds, thereby recorded greater achievement in learning. The senior secondary chemistry students taught using this innovative strategy demonstrated a higher learning gain score over their counterparts who were not exposed to this strategy. This implies that the main effect of the treatment was positively significant on the performance grades of the chemistry students who were taught using the Google classroom Blended learning strategy. However, there was no significant effect of gender on the performance of the chemistry students, despite the treatment given to them. Both the male and female students demonstrated higher performance and positive mean gain in the Post-GCBLCPT scores. This shows that gender has no significant influence on the performance of chemistry students in Nitrogen and its Compounds irrespective of the treatment given or the learning setting. The study therefore concluded that Google Classroom Blended learning strategy is an effective teaching-learning strategy in fostering meaningful learning and enhancing students' performance in Chemistry.

Recommendations

(1) Faculty of Education being responsible for graduating teachers should embrace the use of ICT and digital technology such a Google classroom to equip them with the skills to utilize technology maximally.
(2) Learners should be provided with the necessary tools (by their sponsors) for integration of computer and internet technology into their learning for improved performance.
(3) Faculty of Education and the Ministry of Education should organize workshops and in-service, training for both staff and students where they will learn the essential scientific and practical skills on how to create, design and carry out virtual classroom activation and be able to integrate it in a blended learning situation.
(4) Google classroom should be adopted as a Blended learning technique in the teaching and learning of chemistry at the senior secondary school level to enhance learning and also improve the performance of the students in chemistry.

References

Alan, J. R. & Melvyn, C. U. (2020). *Chemistry/definition, topics, types, history and facts*. Retrieved online on April 3, 2023 from https://www.britannica.com

Arokoyu, A. A. & Ugonwa, R.C. (2012). Assessment of resource availability for chemistry instruction in the secondary schools in Rivers State. *Journal of Emerging Trends in Educational Research and Policy Studies,* 3(3). Elon University, USA. Retrieved 23 March, 2023 from http://www.jeteraps.scholarlinkresearch.org.

Dike, J. W. & Ugonwa, R. C. (2021). Practices of innovative technologies on the academic achievement of science students in Port Harcourt city secondary schools. *Australian Journal of Arts and Scientific Research (AJASR), 26*(1). CQ University Queensland, Australia. www.gubdjournals.org.

Kate, M. (2021). *What is google classroom: Teachers' essential guide to google classroom*. Retrieved April 3, 2023 from https://www.commonsense.org.

Ketut, I. S., Ida, B. M., Nyoman, T. A. & Wayan, L. Y. (2018). The use of google classroom in the learning process. *Journal of Physics: Conference Series, 1175*(1). Retrieved April 2, 2023 from https://iopscience.iop.org>article/

Merrick L. (2018). *How to create effective global e-learning*. Retrieved April 2, 2023, from https://elearningindustry.com/5-top-tips-to-create-effective-global-info

Michael, B. H. & Heather, S. (2014). *Blended: Using disruptive innovation to improve schools*. Retrieved March 24, 2023, from http://blended_learning/innovation/to/improve/schools

Nwanekezi, A.U & Ugonwa, R.C. (2011). Integrating information and communication technology (ICT) into basic science curriculum for quality assurance at the primary education level. *African Journal of Educational Research and Development. 4*(2a) 381-388. University of Port Harcourt

Shana, Z., Alyatim, T. M., Alkhazaleh, M. & Alshalabi, N. (2021). The use of google classroom to support the learning process: Assessing graduate student skills and perceptions. *International Journal of Web-Based Learning and Teaching Technologies (IJWLTT), 16*(5), 171-192. Retrieved April 2, 2023 from https://www.igi-global.com>article

Ugonwa, R. C. & Ndioho, O. F. (2018). Effect of infographics on secondary school chemistry students' performance in Nnewi South Local Government Area of Anambra State. *New Era Research Journal of Human Educational and Sustainable Development (NERJHESSD), 11*(3), 62-71.

Ugonwa R. C. & Nwanekezi, A. U. (2018). Computer animation and secondary school chemistry students' performance in Anambra State. *Australian Journal of Arts and Scientific Research (AJASR), 23*(3), 2018.