
EFFECT OF VIRTUAL LEARNING ON THE ACADEMIC ACHIEVEMENT OF BASIC SCIENCE STUDENTS IN YENAGOA LOCAL GOVERNMENT AREA

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ABSTRACT

This study explored the effects of virtual learning on the academic achievement of basic science students. The study adopted the "pre-test post-test quasi-experimental design". The study's population consisted of all JSS II students in Yenagoa Local Government Area, out of which 147 students were selected to participate in this study through purposive sampling technique. Two intact classes from two schools were used and randomly assigned as the experimental and control groups to be taught using the virtual learning strategy and the modified lecture method. Two research questions and hypotheses were raised. The instrument for data collection is the "Basic Science Achievement Test (BSAT)" which yielded a reliability of 0.87 using Kuder-Richardson Formula 21 (KR-21). Data was analysed using "mean and standard deviation and Analysis of Covariance (ANCOVA)." The findings of the study showed that "there was no significant difference in the mean achievement of students taught through the virtual learning and modified lecture strategy." It was recommended among others that the virtual learning should be used as an alternative to traditional classroom instruction when such traditional instruction is not possible, as they are equally effective.

Keywords: Achievement, BSAT, Gender, IGMLM, IGVVL, Virtual Learning, Lecture Method.

Introduction

Basic science is a crucial part of the basic education curriculum in Nigeria, designed to introduce learners to the wonders of science and the natural world. This interdisciplinary approach combines elements of biology, chemistry, physics, and environmental science, to provide students a thorough understanding of scientific principles (Chima, 2021). Typically initiated during the early years of primary education, this subject lays the groundwork for more advanced scientific learning in later stages. It provides learners with their essential first experience in true science and its methods including making observations, conducting simple investigations, drawing conclusions, etc. (Awodun & Boris, 2020; Samuel, 2018).

However, despite the importance of the basic science field, research reports have continually indicated a trend of underachievement in the subject (Jirgba et al., 2018). Odo et al., (2019) assert this, describing students' performance in basic science as regrettably poor despite the importance of the subject, as observed from chief examiners' reports of examination boards. Studies like those by Ugwumaduka and Ogunyemi (2021) and Samba et al., (2020) presented data on the students' achievement in basic science in Basic Education Certificate Examination (BECE), in varying locations, and reported that most students were unable to achieve a credit pass in the subject.

Lecture instructional strategy has long been a staple of education, whereby an expert (regarded to be the teacher in this case) delivers knowledge to a receptive audience (Tan, 2017). This strategy can be efficient for transmitting information to a several students in a relatively short amount of time (Giorgedze & Dgebuadze, 2017), however, its deficiencies have become increasingly apparent. The lecture method has been criticized for its passive learning nature, being teacher-oriented, content-centered, didactic nature, and its emphasis on rote memorization (Abedi et al., 2019; Saira & Hafeez, 2021). This prominently highlight the need for e-learning approaches like virtual learning, which has emerged as a potential solution that can help bridge the gap and also ensure continuity in education.

Virtual learning falls under the context of e-learning and is a contemporary educational paradigm, that has transformed the way knowledge is shared and acquired. It is conceptually similar to podcasting in that teachers make video and audio recordings available to students, who are then expected to watch or listen to them and learn from them (Molina-Carmona, 2018). Virtual learning comes into play with the advent of digital technologies and has transcended the boundaries of the traditional classroom. Virtual learning will probably have a bigger influence on the future of education, closing gaps and promoting lifelong learning as technology develops. Thus, making it the focus of this study.

Darkwa and Antwi (2021) explored the effectiveness of "online versus classroom learning and their effect on the academic performance of students during the COVID-19 pandemic at the University of Cape Coast, Ghana" and reported no significant difference in the achievement of students taught with the different strategies. Also, Zhang et al., (2023) which assessed "the impact of distance virtual learning on nursing students' course performance during the onset of COVID-19" and reported that students taught using distance learning did not outperform those taught with the traditional face-to-face approach. However, Ajana et al., (2022) explored the "use of virtual learning and its effects on the basic science academic achievement of junior secondary school students in Ojo Local Government Area, in Lagos State" and reported that students taught with virtual learning environment, significantly outperformed those taught with conventional learning environment.

Students' achievement can be affected by a series of other distinct variables, many of which have to do with the demographics of the students. One of such variables is the gender of the students.

Ajana et al., (2022) investigated the use of virtual learning and its effects on the basic science academic achievement of junior secondary school students in Ojo Local Government Area, in Lagos State and reported that gender had no significant impact on the students' academic achievement. Also, Etim et al. (2016) investigated "the impact of virtual learning strategies on academic performance of JS 1 integrated science Students in Secondary schools in Port Harcourt Local Government Area" and reported no significant difference between male and female students. Conversely, Jawad and Shalash (2020) explored the "Impact of e-learning strategy on students' academic achievement in Al- Quds Open University" and reported "the difference between GPA of the students according to gender is statistically significant."

Statement of the Problem

In recent times, the landscape of education in Nigeria has been marked by significant disruptions, primarily attributed to events such as the COVID-19 pandemic, recurring flooding in areas like Bayelsa State, and other unexpected events, leading to closures of physical classrooms. These disruptions have significantly impacted the continuity of education, raising the urgent need for innovative instructional approaches that can ensure uninterrupted learning experiences for students. Virtual learning, facilitated through online platforms, emerges as a potential solution to maintain the continuity of education during such scenarios, with the capacity to mitigate the adverse effects of disruptions in the educational process and ensuring the continuity of education. Given the evolving landscape and the increasing reliance on virtual learning, it is imperative to assess the effectiveness of this model of education on students' academic achievement which is the focus of this study. By doing so, a comprehensive understanding can be gained regarding the extent to which virtual learning can serve as a viable solution during disruptions caused by the aforementioned factors. This study also determines the moderating effect of the students' gender.

Purpose of the Study

The study's purpose is to determine "the effect of Virtual learning on the academic achievement of basic science students in Yenagoa Local Government Area." Specifically, the study is set to determine;

1. The mean achievement of students in basic science when taught with virtual learning through Google classroom and those taught with the modified lecture method.
2. The mean achievement of male and female students in basic science when taught with virtual learning through Google classroom, and the modified lecture method.

Research Questions

1. What is the mean achievement of students in basic science when taught with virtual learning through Google classroom, and those taught with the modified lecture method?
2. What is the mean achievement of male and female students in basic science when taught with virtual learning through Google classroom, and the modified lecture method?

Research Hypothesis

Ho₁: "There is no statistically significant difference in the mean achievement of students in basic science when taught with virtual learning through Google classroom and those taught with the modified lecture method."

Ho₂: "There is no statistically significant difference in the mean achievement of male and female students in basic science when taught with virtual learning through Google classroom, and the modified lecture method."

Method

This study used a "pre-test, post-test control group quasi-experimental design". The study was done in four secondary schools in Yenagoa Local Government Area of Bayelsa State, Nigeria. The four schools were purposively selected and based on the following criteria: "It must be a public secondary school; Basic science teachers at the schools must be professionally qualified, and must have had teaching experience for a minimum of four years; the teachers of the selected schools must be willing to get involved in the experiment."

Two classes each was randomly assigned to an experimental or control group. The intact classes were used as the sample for the control group. For the experimental group, only students with access to mobile phone and internet were selected as sample out of the classes. The final sample size was 147 students.

In order to collect data for this study, three instruments were developed and used, including: "Instructional Guide on Virtual Learning (IGVL), Instructional Guide on the Modified Lecture Method (IGMLM), Basic Science Achievement Test (BSAT)"

The instruments were validated by test experts. The collected data for the BSAT was analysed using the Kuder-Richardson Formula 21 (KR-21), to determine the discriminating indices of the items, and this yielded a reliability coefficient of 0.87

Teachers were trained to utilize IGVL and IGMLM throughout the first week. The second week was spent on the administering BSAT pre-test. The experimental (IGVL) and control group (IGMLM) received the treatment throughout the next two weeks. The following week (fifth), was used for the administration of the post-test.

Method of Data Analysis

The four research questions were answered using the statistical tool of mean and standard deviation. The hypotheses were analysed using Analysis of Covariance (ANCOVA) at 0.05 level of significance.

Results

Research Question One

What is the mean achievement of students in basic science when taught with virtual learning through Google classroom, and those taught with the modified lecture method?

Table 1

Summary of Mean and Standard Deviation of Students' Pre-test and Post-test Scores showing the Effects of Instructional Strategies on the Achievement of Students in Basic Science

Treatment	N	Pre-test Scores		Post-test Scores		Mean Gain
		Mean	SD	Mean	SD	
Virtual Learning	63	35.68	8.39	59.17	10.49	23.49
Modified Lecture	84	36.86	7.50	57.0	10.57	20.14
Total	147	36.35	7.89	57.92	10.55	21.57

Source: Field work

Table 1 reveals that the posttest means achievement score of students who were taught using virtual learning (M = 59.17, SD = 10.49) was larger than that of students taught using the modified lecture approach (M = 57.0, SD = 10.57). The table further shows that the mean gain scores of students taught with virtual learning (23.49) was higher than that of students taught with the modified lecture method (20.14). Consequently, ANCOVA was carried out to ascertain significance.

Research Question Two

What is the mean achievement of male and female students in basic science when taught with virtual learning through Google classroom, and the modified lecture method?

Table 2

Summary of Mean and Standard Deviation of Pre-test and post-test scores on the Effects of Instructional Strategies on Achievement of Male and Female Students in Basic Science

Treatment	Gender	N	Pre-test Scores		Post-test Scores		Mean Gain
			Mean	SD	Mean	SD	
Virtual Learning	Male	26	34.92	6.55	58.0	9.34	23.08
	Female	37	36.22	9.51	60.0	11.27	23.78
	Total	63	35.68	8.39	59.17	10.49	23.49
Modified Lecture Method	Male	41	35.61	6.42	59.52	8.39	23.91
	Female	43	38.09	8.35	54.48	11.9	16.39
	Total	84	36.86	7.50	57.0	10.57	20.14
Total	Male	68	35.35	6.43	58.94	8.73	23.59
	Female	79	37.22	8.90	57.06	11.89	19.84
	Total	147	36.35	7.89	57.92	10.55	21.57

Source: Field work

Table 2 shows that for students taught with virtual learning, the posttest mean achievement score of female students (M = 60.0, SD = 11.27) was higher than male students (M = 58.0, SD = 9.34). For students taught with the modified lecture method, the posttest means

achievement score of male students ($M = 59.52$, $SD = 8.39$) was higher than female students ($M = 54.48$, $SD = 11.9$). In total, male students had a better mean achievement score ($M = 58.94$, $SD = 8.73$) than females ($M = 57.06$, $SD = 11.89$). The table further shows that male students had a greater total mean gain score (23.59) than female students (19.84). Consequently, ANOCOVA was carried out to ascertain the statistical significance.

Research Hypothesis

Null hypothesis One

H_{01} : There is no statistically significant difference in the mean achievement of students in basic science when taught with virtual learning through Google classroom and those taught with the modified lecture method.

Table 3

One-way Analysis of Covariance of the Post-test Achievement Scores of Students Taught Basic Science through the Virtual Learning and the Modified Lecture Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	445.295 ^a	2	222.648	2.026	.136	.027
Intercept	27203.413	1	27203.413	247.585	.000	.632
Pretest	275.055	1	275.055	2.503	.116	.017
Instructional Strategies	138.902	1	138.902	1.264	.263	.009
Error	15822.025	144	109.875			
Total	509616.000	147				
Corrected Total	16267.320	146				

a. R Squared = .027 (Adjusted R Squared = .014), *Sig at $p = 0.05$ alpha level

The result in Table 3 shows that "there is no significant main effect of instructional strategy on students' achievement scores in basic science", $F(1, 144) = 1.264$, $p = .263$, partial eta squared = .009. This gives an effect size of just 9%. Thus, the null hypotheses which states that "there is no statistically significant difference in the mean achievement of students in basic science when taught with virtual learning through Google classroom and those taught with the modified lecture method" was accepted.

Null Hypothesis Two

H_{02} : There is no statistically significant difference in the mean achievement of male and female students in basic science when taught with virtual learning through Google classroom, and the modified lecture method.

Table 4

Two-way Analysis of Covariance of the Post-test Achievement Scores of Male and Female Students taught Basic Science through the Virtual Learning and the Modified Lecture Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	972.639 ^a	4	243.160	2.258	.066	.060
Intercept	26076.453	1	26076.453	242.101	.000	.630
Pretest	206.271	1	206.271	1.915	.169	.013
Instructional Strategies	114.310	1	114.310	1.061	.305	.007
Gender	53.324	1	53.324	.495	.483	.003
Instructional Strategies * Gender	416.370	1	416.370	3.866	.051*	.027
Error	15294.681	142	107.709			
Total	509616.000	147				
Corrected Total	16267.320	146				

a. R Squared = .060 (Adjusted R Squared = .033), *Sig at p = 0.05 alpha level

Table 4 shows that "there is no significant interaction effect of gender and instructional strategies on student's achievement in basic science when taught with the instructional strategies", $F(1, 142) = 3.866$, $p = .051$, partial eta squared = .027. This gives an effect size of 27%. Thus the null hypothesis which states that "there is no statistically significant difference in the mean achievement of male and female students in basic science when taught with virtual learning through Google classroom, and the modified lecture method" was accepted.

Discussion of Findings

1. The findings of this study showed that "there is no statistically significant difference in the mean achievement of students in basic science when taught with virtual learning through Google classroom and those taught with the modified lecture method." This agrees with that of Darkwa and Antwi (2021) and Zhang et al., (2023) who reported "no significant difference in the achievement of students taught with the difference strategies." However, this findings disagrees with Ajana et al., (2022) who reported that students taught with virtual learning environment, significantly outperformed those taught with conventional learning environment.

2. The findings showed that "there was no statistically significant difference in the mean achievement of male and female students in Basic Science when taught with virtual learning through Google classroom, and the modified lecture method." This agrees with Ajana et al.,

(2022) and Etim et al.,(2016) which reported "no significant difference between male and female students." Conversely, this findings disagrees with Jawad and Shalash(2020) who reported the "difference between GPA of the students according to gender is statistically significant."

Conclusion

Virtual learning approach and lecture method are equally effective for classroom instruction. As such, either could be used without losing out on better instruction. Thus, the virtual learning approach can be adopted in cases where normal lectures are not possible.

Additionally, no special consideration needs to be given to student's gender in classroom instruction as there is no influence of gender on student's academic achievement.

Recommendations

1. Educational institutions and teachers should adopt the use of virtual learning as an alternative when physical lessons are not possible rather than halting the while educational process like during floods
2. Government and educational stakeholders should create training opportunities for teachers to effectively make use of virtual platforms to carry out Instruction
3. Government and other stakeholders should provide resources to support digital or virtual learning as when needed, including devices, internet access, and software.
4. Teachers and educational institutions should combine virtual learning with traditional instruction to leverage the strengths of both approaches.
5. Alternative approaches for virtual learning should be explored to enhance students' achievement.

References

- Abedi, P., Keshmirshekan, M. H. & Namaziandost, E. (2019). The comparative effect of flipped classroom instruction versus traditional instruction on Iranian intermediate EFL learners' English composition writing. *Journal of Applied Linguistics and Language Research*,6(4), 43–56.
<https://www.researchgate.net/profile/EhsanNamaziandost/publication/335636035>
- Ajana, O.E., Collins, A.I., & Afolabi, K.T. (2022). Virtual learning and academic performance of junior secondary school students in ojo local government area in Lagos state. *Lasu International Journal of Arts and Social Sciences Education*, 1(1), 25-36. <https://ijassed.org/wp-content/uploads/2022/05/25-36-DR-AJANA-Virtual-learning-and-academic-performance-of-junior-secondary-school-students-in-Lagos-State.pdf>
- Awodun, A.O., & Boris, O.O. (2020). Effects of Outdoor Teaching Strategy On Students' Academic Achievement In Basic Science In Secondary School In Ekiti State, Nigeria. *International Journal of Innovative Research and Advanced Studies*, 7(10), 71-76.
https://www.ijiras.com/2020/Vol_7-Issue_10/paper_11.pdf

- Chima, T.S. (2021). Basic science curriculum and development in Nigeria: Post Covid-19 challenges and prospects. *Unizik Journal of Educational Research and Policy Studies*, 7, 100-114. <https://unijerps.org/index.php/unijerps/article/download/148/137>
- Darkwa, B. F., & Antwi, S. (2021). From classroom to online: Comparing the effectiveness and student academic performance of classroom learning and online learning. *Open Access Library Journal*, 8, Article e7597. <https://doi.org/10.4236/oalib.1107597>
- Etim, P. J., Udosen, I. N., & Wordu, N. C. (2016). Use of virtual learning on academic performance of JS 1 integrated science students in secondary school in Port Harcourt Local Government Area. *Modern Applied Science*, 10(8), 256–263. <https://doi.org/10.5539/mas.v10n8p256>
- Giorgdze, M. & Dgebuadze, M. (2017). Interactive teaching methods: challenges and perspectives. *International E-Journal of Advances in Education*, 3(9), 544–548. <https://dergipark.org.tr/en/download/article-file/390165>
- Jawad, Y.A.L.A., & Shalash, B. (2020). The Impact of E-Learning Strategy on Students' Academic Achievement Case Study: Al-Quds Open University. *International Journal of Higher Education*, 9(6), 44-53. <https://doi.org/10.5430/ijhe.v9n6p44>
- Molina-Carmona, R., Pertegal-Felices, M.L., Jimeno-Morenilla, A., & Mora-Mora, H. (2018). Virtual learning activities for multimedia students to enhance spatial ability. *Sustainability*, 10, 1024. <https://doi.org/10.3390/su10041074>
- Ode, J. O., Agbike, J.E., Abah, J.C. & Chia, A.F. (2019), Gender Differentials in Basic Science Students' Achievement in Basic Certificate Examination in Makudi Local Government Area of Benue State. *Education Review Letters*, 4(12), 7. <http://www.scholarj.com/articles/ED04120107y.pdf>
- Saira, N. Z. & Hafeez, M. (2021). A critical review on discussion and traditional teaching methods. *Psychology and Education Journal*, 58(1), 1871–1886. <https://doi.org/10.17762/pae.v58i1.1042>
- Samba, R. M. O., Achor, E. E., Bash, A. E., & Iortim, S. O. (2020). Fostering Students' Critical Thinking and Achievement in Basic Science Using Graphic Organizer and Experiential Learning Strategies with Feedback. *Science Education International*, 31(2), 220–225. <https://doi.org/10.33828/sei.v31.i2.12>
- Tan, C. (2017). Constructivism and pedagogical reform in China: Issues and Challenges. *Globalization, Societies and Education*, 15(2), 238-247. <https://doi.org/10.1080/14767724.2015.1105737>
- Ugwumaduka, E., & Ogunyemi, O. (2021, May 8). Formative Assessment, Feedback, Remediation and Students' Academic Achievement in Basic Science: A Quasi-Experiment. *African Journal of Education, Science and Technology*, 6(3), Pg 337-349. <https://doi.org/https://doi.org/10.2022/ajest.v6i3.559>
- Zhang, Y., Zhang, N., Liu, H., Kan, Y., & Zou, Y. (2023). The impact of distance education on nursing students' course performance in a sino-foreign cooperative program during the onset of COVID-19: a quasi-experimental study. *BMC Nursing*, 22(1), 16. <https://link.springer.com/article/10.1186/s12912-022-01136-1>