



Effectiveness of Blended Learning Teaching Method on Chemistry Students Academic Achievement in Akwa Ibom North East Senatorial District

Nsikak, Patrick Okono & Gloria N. Eze

Department of Science Education, Michael Okpara University of Agriculture, Umudike

Corresponding Author: nsikakokono350@gmail.com

Abstract

This study focused on the effectiveness of blended learning teaching method on Chemistry students' academic achievement in Akwa Ibom North East Senatorial District. Two research questions and two hypotheses were stated. Quasi-Experimental non-equivalent pretest, posttest design was adopted for the study. The sample of the study was 105 SS two students (54 males and 51 females) from four intact classes and two schools that participated in the study. Purposive sampling technique was used. A 40 item four options multiple choice Chemistry Achievement Test (CAT) from the content area of Chemical Bonding in Chemistry scheme was used. The instrument was face and content validated. Kuder Richardson 20 (KR20) was used to establish the reliability of the instrument and reliability index of 0.85 was obtained. Data collected were analysed using mean and Analysis of Covariance. It was found out that there is a significant difference in the mean achievement scores of students taught chemical bonding using blended learning strategy and those taught using lecture method in favour of those taught using blended learning. There is also a significant difference between the mean achievement scores of male and female students taught the concepts of chemical bonding using blended learning strategy in favour of the male that achieved more than the female. Based on the findings it was recommended that chemistry teachers should use blended learning strategy in teaching and learning of chemistry in secondary schools since it enhances students' achievement in Chemistry. Workshop/conferences should be organized by science teacher association to Chemistry teacher on the use of blended learning in teaching and learning of Chemistry and blended learning strategy should be recommended for adoption in the science curriculum.

Key words: Academic achievement, Blended learning, chemistry students

Introduction

Science is an integral part of human society whose impact is felt in every sphere of human life, so much that it is intricately linked with a nation's development. Without science; there cannot be intuition for technology (Odeleye, Olusola, & Awodun, 2017). Science as a branch of knowledge is the systematic study of things around us. The totality of knowledge obtained from such studies constitutes scientific knowledge. It is a field of study that is basically concerned with the understanding of the physical world. This understanding enables scientists to uncover the nature of things and events and to harness such things and events for the benefit of mankind (Onyeneke, 2021).

Chemistry is a branch of Science that is fundamental to everyone's life and permeates almost every aspect of man's existence. The study of Chemistry is beneficial to the students because, it can equip them

with entrepreneurial skills needed to create jobs (Ibiyengibo & Nenalebari, 2022). Chemistry has been identified as the core of the basic sciences and one of the science subjects stipulated by the National Policy on Education (FRN, 2013) that students must compulsorily offer to enable them gain admission into Nigerian tertiary institutions to study any of the sciences and science related courses. Chemistry embraces several fields of study and candidates are expected to satisfy the requirement of at least a credit in chemistry in the West African Senior School Certificate Examination to qualify to study courses like Medicine, Pharmacy, Industrial Chemistry, Biochemistry, Chemical Engineering, and agronomy in tertiary institutions (Jegede, 2019).

In spite of the importance of Chemistry, candidate enrolment and performance in chemistry have not been impressive over the years. Some researchers



(Ogunleye, 2017; Fabian, 2022) have observed that the failure rate in chemistry at senior school certificate examinations has been persistently high. This trend has generated concern among scholars, parents, educators, scientists and the government and could be blamed on questionable subject matter knowledge, instructional method, instructional materials or assessment techniques. The persistent poor performance of students in chemistry at School Certificate level has given rise to an assumption that most Chemistry teachers in secondary schools in Nigeria probably do not make use of varying form of teaching strategies to be able to cope with some specific difficulties associated with the teaching of Chemistry (Ogbeba, 2016).

The consistent poor performance of students in chemistry in both internal and external examinations indicates that some concepts in chemistry appear so abstract and difficult to students in almost all levels of education (Cookey, 2021). In order to reduce the abstractness of concepts, it is thus necessary for teachers to use innovative and interactive methods of teaching that would enhance students' achievement in chemistry. This means that for effective instructional purpose, emphasis should be more on students' participatory learning approach as this makes the learners active as compared to the conventional lecture method which presents many challenges to both teaching and learning processes.

The conventional lecture method of teaching is a method where ideas, concepts, generalization and facts are presented by the teachers to the students who are mainly passive hearers. The students on their own part are expected to memorize the fact and principles presented to them whether they understood or not and even produce verbatim during examination. The conventional lecture method involves a formal discourse or exposition on a subject matter to attain a stated instructional objective, the teacher does the talking while the learners listen and occasionally take notes (Oviawe, 2017). The teacher conducts him/herself as the custodian of knowledge which he/she dishes out in form of ideas, opinions, and information and backs them up with citations of reputable authors. It is characterized by teacher dominance and little or no students' participation. The one-way exchange of knowledge between teachers and students with the conventional lecture method often makes chemistry lesson boring, less interesting and abstract and could lead to poor academic achievement of students.

With the growing concern in recent times to have a classroom that is student-centered, activity oriented and

focused on understanding in order to facilitate learning for the majority of students, there is the urgent need to explore new approaches with potentially radical teaching applications. In this regard, there is need for teachers and instructors to incorporate blended learning in teaching and learning processes to give students the opportunity to engage actively in the teaching/learning process. Etim (2016) alleged that the integration of blended learning environment in classroom teaching has brought education one step higher from the traditional teaching method to a more integrative method of teaching. Blended learning is an educational approach that combines face-to-face instruction with online learning in a virtual environment (Setiawan, Muhtadi & Hukom, 2022).

Combining the best learning opportunities between these two approaches makes it possible to tailor instruction to the needs of individual students and to the desired outcome to be attained by the end of the term (Al-abdallat, Alnashash, & Alz-boun, 2020). Blended learning is a student-centred, teacher-facilitated instructional strategy that uses technology to boost independence, engagement, and achievement (Ceylan & Kesici, 2017). Blended learning creates a flexible learning environment that allows students to repeat lessons at the right time and place by easily accessing and selecting learning contents which in turn enhance students' academic performance (Zhang & Zhu, 2017). Blended learning is a teaching approach that positively impacts students' learning and teachers' instruction. Through individual interaction with students, teachers can see the learning needs of students, thereby allowing them to adjust or design lesson plans to suit students' learning progress which in turn can enhance students' academic achievement (Barros, Simmt & Maltempi, 2017).

Academic achievement is a variable in students' learning and is a matter of concern in present day researches. Academic achievement is the level of performance in the subject as exhibited by an individual. According to Ogundukun, and Adeyemo (2017), academic achievement is the exhibition of knowledge attained or skills developed by students in the school subject usually designed by test scores or by marks assigned by teachers which can be low or high. Usman (2017) alleged that the persistent poor academic achievement is attributed to teacher instructional strategies. Thus, instructional strategies used by teachers in teaching-learning process have significant influence on learners' academic achievement. The perception of students on any particular instructional

strategy adopted by the teacher in the classroom may vary based on the student's gender.

Gender is the range of physical, biological, mental and behavioural characteristics pertaining to and differentiating between the feminine and masculine (male or female) population. It relates to the difference in sex (that is either male or female) and how this quality affects their dispositions and perception toward life and academic activities (Onofiok, 2017). The importance of examining students' academic achievement in relation to gender is based primarily on the socio-cultural differences between girls and boys. In view of this belief, gender issue in education has attracted the attention of many researchers; and while gender differences in students' academic achievement in chemistry remain inconclusive. This study, therefore sought to examine the comparative effectiveness of blended learning and the lecture teaching method on secondary school student's academic achievement in Chemistry.

Statement of Problem

In spite of the importance of chemistry to the students, research shows that students' academic achievement in both internal and external examinations have been very poor. This is further supported by the West African Examination Council Chief Examiner's Report (2023), that the achievement of students in chemistry at the end of secondary education has remained poor. This poor achievement of students in chemistry could be attributed to the methods employed by the teachers in delivering lessons to the students.

The interaction of the researcher with some students and teachers in public secondary schools in Akwa Ibom State reveal that the dominant method of teaching is the conventional lecture method. The one-way exchange of knowledge between teachers and students with this method often make students passive. It also makes lesson boring, less interesting and abstract and can lead to poor academic achievement. This therefore calls for the adoption of interactive teaching strategies that engage students actively in the learning process. It is important to adopt a method that would give the students opportunity to engage actively in the lesson and could lead to effective academic achievement. Therefore, the problem of this study is to find out effect of blended learning and the lecture teaching method on secondary school student's academic achievement in Chemistry.

Research Questions

The following research questions are raised to direct the study:

1. What is the difference in the mean achievement scores of students taught the concept of chemical bonding using blended learning and those taught using the lecture method?
2. What is the difference in the mean achievement scores of male and female students taught the concept of chemical bonding using blended learning?

Hypotheses

The following null hypotheses are formulated to direct the study:

1. There is no significant difference in the mean achievement scores of students taught the concept of chemical bonding using blended learning and those taught using the lecture method.
2. There is no significant difference in the mean achievement scores of male and female students taught the concept of chemical bonding using blended learning

Method

The study is a non-randomized non-equivalent pre-test, post-test quasi-experimental design carried out in Akwa Ibom North East Senatorial District Nigeria. The population was 11, 180 (5,676 males and 5,504 females) senior secondary two (SSII) Chemistry students from 89 public secondary schools. The sample of the study was 105 SS two students (54 males and 51 females) from four intact classes in two schools participated in this study. Purpose sampling technique was used to ensure that the schools sampled are coeducational school because of the gender in the study and school that have chemistry teachers who can handle the blended learning strategy. Two schools were purposively sampled making use of two intact classes in each school. One school was assigned to experimental group and the other control group. A 40 item four options multiple choice Chemistry Achievement Test (CAT) from the content area of Chemical Bonding in Chemistry scheme was used. The items were adapted from senior secondary School WAEC past questions and answer booklets. To ensure content validity of the instrument, test blue print was used in other to ensure adequate distribution of the

questions based on the content. The instrument was given to three experts, two Chemistry Education teacher and one Measurement and Evaluation expert. The instrument was pilot tested and kuder Richardson (K20) was used to establish the reliability of the instrument and reliability index of 0.85 was obtained. The instrument was administered in two stages (pre-test and post-test). Any correct answer got 2 ½ marks while wrong answer got zero mark. The maximum score was 100. The pre-test was administered to both experimental and control groups before treatment (instruction). The experimental groups were taught using blended learning while the control groups were taught using conventional method. The teaching was done by the regular teacher of the schools through the

guidance of the researchers and using lesson plan developed by the researchers. The researchers closely monitored the teaching in both groups. At the end of the instruction which lasted six weeks, post test was administered. The scripts were collated and scored by the researchers. This was to ensure control of teachers' variable. The scores (data) were analysed using mean and standard deviation to answer the research questions and analysis of covariance (ANCOVA) to test the hypotheses at 0.05 levels of significance. ANCOVA was used to remove non-equivalence among research objects since intact classes were used for the study. Reject H_0 if the test statistic is greater than the critical value or if the critical value is greater than test statistics do not reject the H_0

Results

The results were presented as follows

Research Question One:

Table 1: Mean achievement and gain scores of students taught chemical bonding with blended learning instructional strategy and those taught with lecture method.

Methods	N	Pre-test mean (\bar{X})	SD	Post-test mean (\bar{X})	SD	Mean Achievement Gain
Blended learning	48	21.08	6.73	68.46	9.91	47.38
Lecture	52	24.19	8.17	59.12	9.83	34.93

Table 1 shows the pre-test and post-test means with the standard deviation scores of the two teaching methods – blended learning and lecture. Students taught with blended learning instructional strategy had pre-test mean score of 21.08 with 6.73 as the standard deviation score and a post-test mean score of 64.46 with standard deviation score of 9.91 giving a mean achievement gain score of 47.38; While lecture method with pre-test mean score of 24.19 and post-test mean score of 59.12 with

standard deviation scores of 8.17 and 9.83 respectively has a mean achievement gain score of 34.93. These imply that learning took place with the two methods but blended learning strategy was the best in enhancing achievement of students in chemical bonding with lecture method coming last. In order to ascertain the level of significance, the data was subjected to hypothesis testing as shown below.

Hypothesis One

Table 2: Analysis of covariance (ANCOVA) on the mean achievement scores of students taught chemical bonding using blended learning strategy and those taught with lecture method.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	8184.898 ^a	2	4092.449	112.230	.000
Intercept	15732.223	1	15732.223	431.434	.000
Pretest	6006.112	1	6006.112	164.709	.000
Method	3786.796	1	3786.796	103.848	.000
Error	3537.102	97	36.465		
Total	416218.000	100			
Corrected Total	11722	99			

a. R Squared = .698 (Adjusted R Squared = .692)

Table 2 has shown that F-ratio (103.848) is significant at .000 for the methods, at 1 and 99 degrees of freedom (df). This is because, .000 is less than .05 significant level earlier set for the hypothesis. Hence the hypothesis

is rejected, therefore, there is a significant difference in the mean achievement scores of students taught chemical bonding using blended learning strategy and those taught using lecture method.

Research Question 2:

Table 3: Mean achievement and gain scores of male and female students taught chemical bonding with blended learning instructional strategy.

Gender	N	Pre-test mean (\bar{X})	SD	Post-test mean (\bar{X})	SD	Mean Achievement Gain
Males	26	22.09	7.19	71.38	8.73	49.29
Females	22	19.91	6.09	65.00	10.29	45.09

Table 3 shows the pre-test and post-test means with the standard deviation of male and female students taught with blended learning strategy. Males taught with blended learning strategy had pre-test mean score of 22.09 with 7.19 standard deviation score and a post-test mean score of 71.38 with 8.73 standard deviation score giving a mean achievement gain score of 49.29. Females taught with blended learning strategy had a

pre-test mean score of 19.91 and post-test mean score of 65.00 giving a mean achievement gain score of 45.09. These indicate that learning took place with each gender but male gender's achievement was enhanced more than that of the female gender using blended learning strategy. It was further subjected to hypothesis testing to ascertain the level of significant.

Hypothesis Two:

Table 4: Analysis of covariance (ANCOVA) on the mean achievement scores of male and female students taught chemical bonding using blended learning strategy.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	3122.603 ^a	2	1561.301	47.175	.000
Intercept	8476.249	1	8476.249	256.112	.000
Pretest	2636.840	1	2636.840	79.673	.000
Gender	180.019	1	180.019	5.439	.024
Error	2678.247	45	33.096		
Total	229566.000	48			
Corrected Total	4611.917	47			

a. R Squared = .677 (Adjusted R Squared = .663)

Result on Table 4 reveals that the f value of (5.439) is significant at .024 for gender at 1 and 47 degrees of freedom. This is because, .024 is less than .05 significant level earlier set for the hypothesis. Therefore, the null hypothesis is rejected. There is a significant difference between the mean achievement scores of male and female students taught the concepts of chemical bonding using blended learning strategy.

Discussion of findings

The discussions of the results are based on the research questions that guided the study and hypotheses

The result of this study showed that there is a significant difference in the mean achievement scores of students taught chemical bonding using blended learning strategy and those taught using lecture method. The higher achievement of students exposed to blended learning may be due to Blended learning creates a flexible learning environment that allows students to repeat lessons at the right time and place by easily accessing and selecting learning contents which in turn enhance students' academic performance. This is in line with the view of Ceylan & Kesici, (2017) who refers Blended learning is a student-centred, teacher-facilitated instructional strategy that uses technology to boost independence, engagement, and achievement. This finding is in line with the finding of Green and Owo (2021) that investigated the effectiveness of the blended learning technique and lecture method on students' academic achievement in Basic Science in Junior Secondary Schools in Obio/Akpor LGA Rivers State and reported that the blended learning strategy significantly improved students' achievement better than the lecture method. In agreement with the finding also Ilo, Alison, Okeke, and Ibe (2022) examined the

effect of blended learning instructional strategy on secondary school student's academic achievement in Physics and reported that Blended learning instructional strategy is more effective in enhancing students' achievement in Physics compared with conventional teaching method.

The result of the study further showed that there is a significant difference between the mean achievement scores of male and female students taught the concepts of chemical bonding using blended learning strategy in favour of the male who outperform the female students. The difference is not far from stereotypes that science is masculine and difficult discourage many girls. This finding is in disagreement with Igiri (2021) that examined the influence of gender on academic achievement in Chemistry among senior secondary school students in Calabar metropolis, Cross River State and found that gender has no significantly influence on academic performance in Chemistry among senior secondary school students in Calabar metropolis. On the other hand, this finding is in agreement with Ilo, Alison, Okeke, and Ibe (2022) that examined the effect of blended learning instructional strategy on secondary school student's academic achievement in Physics based on gender and reported that achievement of male students taught Physics with blended learning instructional strategy is slightly higher female students taught Physics with blended learning instructional strategy.

Conclusion

Based on the findings, it has been shown that the use of blended learning strategy is a way of improving academic achievement of students in Chemistry which will enable them to take science as option in their higher

Education. Blended learning having shown to improve students learning of chemistry, the continuous use of conventional method in teaching science should be discarded. There is a significant difference between the mean achievement scores of male and female students taught the concepts of chemical bonding using blended learning strategy in the favour of the male that achieved more than the female students when exposed to blended learning.

Recommendations

The following recommendations were made based on the findings of the study.

1. Blended learning strategy should be used by chemistry teachers in teaching and learning of chemistry in secondary schools since it enhances students' achievement in Chemistry.
2. Workshop/ conferences should be organized by the science teacher association to Chemistry teacher on the use of blended learning in teaching and learning of Chemistry.
3. Blended learning strategy should be recommended for adoption in the science curriculum by the science teacher association of Nigeria (STAN)

References

- Al-abdallat, M. F., Alnashash, R. M., and Alz-boun, M. S. (2020). The effect of teaching using blended learning on the achievement of 10th-grade students in the computer course. *Journal of Education and Practice*, 11(21), 159–167.
- Barros, A. P., Simmt, E. and Maltempi M.V. (2017). Understanding a Brazilian high school blended learning environment from the perspective of complex systems. *Journal of Online Learning Research*, 3 (1), 73-101
- Ceylan, V. K., and Kesici, A. E. (2017). Effect of blended learning on academic achievement. *Journal of Human Sciences*, 14(1), 308-319
- Cookey, H.U. (2021). *Effect of inquiry based teaching method on secondary schools students achievement in chemistry in Opobo/Nkoro Local Government Area of Rivers State*. B.Ed Project, University of Port Harcourt.
- Etim, P. (2016). *Principles of Instructional Design and Communication*. Mcf Nigeria Limited, Uyo. Printex press Ltd.
- Fabian, R. (2022). School variables and students academic performance in Biology in secondary schools in Okigwe Local Government Area of Imo State. *Blossom University Journal of Research and Innovation*, 3(12): 351-359
- Federal Ministry of Education (2013) *National Policy on Education*. Abuja: NERDC Press.
- Ibiyengibo, A. and Nenalebari, N.J. (2022). Factors responsible for low enrolment in chemistry as perceived by chemistry education students in Ignatius Ajuru University of Education, Port Harcourt, Rivers State, Nigeria. *GSC Advanced Research and Reviews*, 12(03), 123–130
- Igiri, U. (2021). *Influence of gender on academic achievement in Chemistry among senior secondary school students in Calabar Metropolis, Cross River State*. B.Ed Seminar, University of Calabar
- Ilo, U. C., Alison, V. U., Okeke, C. P. and Ibe, F. N. (2022). Effect of Blended Learning Instructional Strategy on Secondary School Student's Academic Achievement in Physics. *International Journal of Research Publication and Reviews*, 3(8):935-940,
- Jegede, S. A. (2019). Remediation of students' weaknesses for enhanced achievement in chemistry. *Greener Journal of Educational Research*, 2 (4) :95-99
- Odeleye, O.A, Olusola, J .S and Awodun, A. O (2017). *Enhancing the Integrity of Educational Evaluation; Curbing the menace of Test and Examination Malpractices in Nigeria*. A Joint Publication of the Department of Business Administration and Education Management. Lead City , Ibadan, Oyo State. Nigeria
- Ogbeba, J. A. (2016). *Effect of prior knowledge of instructional objectives on senior secondary school students' motivation and achievement in Chemistry*. Ph.D. thesis, Faculty of Education, Benue State University, Makurdi
- Ogundokun, M. O. and Adeyemo, D. A. (2017). Emotional Intelligence and Academics: The moderating influence of age, intrinsic and extrinsic motivation. *Journal of African Research Network*, 10(2): 8 – 13.
- Ogunleye, B.D. (2017). *School environmental variables and students academic performance in Chemistry*. Ph.D thesis, Department of Teacher Education, University of Ibadan, Ibadan.
- Onofiok, B. W. (2017). *A path analytic study of some psycho-personal and school variables on students' academic performance in Civic Education in Akwa Ibom State*. Ph.D Thesis, University of Uyo, Uyo.



- Onyeneke, Y. (2021). Effect of virtual field trips on students academic performance in Chemistry in secondary schools in Port Harcourt Metropolis, Rivers State, Nigeria. *International Journal of Education and Evaluation*, 5(1): 67-87
- Oviawe, J.I. (2017). *Differential effects of three instructional methods on students' performance in building technology in polytechnics in Nigeria*. PhD Thesis, University of Nigeria, Nsukka.
- Setiawan, A. A., Muhtadi, A., & Hukom, J. (2022). Blended learning and student mathematics ability in Indonesia: A meta-analysis study. *International Journal of Instruction*, 15(2): 905-916.
- Usman, I. A. (2017). *The Relationship between students' performance in practical activities and their academic achievements in integrated science*. Ph.D Thesis, Ahmadu Bello University, Zaria.
- WAEC (2023). *West African examination council: Chief examiners reports*, WAEC Press.
- Zhang, W. & Zhu, C. (2017). Review on blended learning: identifying the key themes and categories. *International Journal of Information and Education Technology*, 7 (9), 673-678