

# Blended Instructional Strategy and Students' Achievement and Retention in Chemistry in UYO L.G.A, Nigeria

## Article History

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**Abstract:** This study examined the effect of blended strategy on students' achievement and retention in chemistry. Three research questions and hypotheses were formulated and quasi-experimental design was adopted. 100 chemistry students, in two intact classes, in two co-educational public secondary schools, in Uyo L. G. A, Akwa Ibom State was selected using random sampling technique made up the sample. Two researcher made instruments containing 25 items each were used. The instruments were Chemistry Achievement Test (CAT) and Chemistry Retention Test (CRT). Reliability coefficient was determined using Kuder Richardson formular 20 (KR-20). The results showed reliability co-efficient of 0.72 for the CAT and CRT. The research assistants were guided to teach the concept of chemical combination using blended learning and expository strategies using lesson guides. Analysis of Covariance (ANCOVA) was the statistical tool used. The result indicated a significant difference in the mean performance scores of chemistry learners instructed using blended strategy than those instructed using expository method in favour of the experimental group. A significant difference existed in the mean retention scores of chemistry learners taught chemical combination with blended strategy than those taught with expository strategy. Gender was found not to be statistically significant. Arising from the findings of the study, it is recommended that teachers of chemistry should make effective use of blended instructional strategy in the teaching of concepts in chemistry.

**Keywords:** Blended Learning, Expository Strategy, Performance, Retention, Gender.

## 1. Introduction

Science and technology education is vital to national growth and technological development. In Nigeria, science and technology education is modeled to ensure that the country has a population of trained and competent scientists to drive its technological advancement. Technological advancement has brought new opportunities, facilitating many innovative approaches in educational sector, enriching the teaching and learning experience. Technology has changed the way teaching is done and the way students learn stimulating students' interest, curiosity and motivation.

In spite of the significant role of chemistry in industrial and technological development of the society, chemistry students have continued to experience a decline in academic performance in external examination like NECO and WASSCE in Nigeria. Several factors have been identified such as infrastructural problem, poor study habits, poor retention, gender, teachers' attitude to work and application of ineffective teaching strategies among others. Of all these factors, instructional strategies employed by teachers appear overbearing because of its facilitating effect in understanding the concept taught. Efforts to improve instructional delivery by chemistry teachers through the use of students-centered instructional strategies have been advocated by chemistry educators (Udofia and Edem, 2019).

The teaching of chemistry needs the use of appropriate instructional strategy capable of creating an interactive learning environment for meaningful learning and understanding of concepts to enhance a better academic achievement and retention in the subject. Chemistry teachers therefore need to be conversant with numerous and innovative teaching strategies that take recognition of the magnitude of complexity of the concepts to be taught. Student retention ability could improve if chemistry teachers employ strategies that would enhance effective assimilation of information towards meaningful recall and retrieval when the need arises. There is need for teachers to adopt new teaching and learning strategies made available with changes and advances in information technology such as blended strategy to promote students' performance and retention in chemistry.

The term blended learning refers to the use of online platforms and applications to deliver a lesson while teacher facilitates instruction (Bazelais and Doleck, 2018).

Blended learning comprises of (1) face to face and online teaching (2) integration of technology, and (3) mixture of methodology. Many terms like hybrid, mixed or integrative are used to describe the same blended learning.

Blended learning environments also provide social interaction and collaboration which is not present in full online systems. In blended learning environment teachers' communication with students is direct or indirect, and not limited by time. Blended learning gives learners the chance to make choices in their learning, such as what and how students study.

In a blended model, lectures can be videotaped ahead of time so that students can watch on their own. Other feature in blended are simulations and web-based tests. The classroom time is structured for exercises that feature the application of the curriculum to work through tasks.

The teachers' role is of a facilitator who guides the students with the skill and knowledge required to use the online material as well as independent study time. The facilitator focuses on the following areas: planning the lesson/integrating the e-learning component into traditional face to face learning, designing, facilitation of communication with and among students including the pedagogy of communicating content, guiding the learning experience of students and customizing materials to strengthen the learning experience, finally assessment and grading of students.

By using a combination of digital instruction and one on one face time, students can work individually and teachers are able to support individual student who may need individual attention. McLaughlin *et al.* (2015) and Hesse (2017) observed that the use of blended learning improves students' performance than purely face – to- face or purely online classes.

Dangwal and Lalima. (2017) and Maccoun (2016) also opined that blended learning strategy could decrease student attrition, promote performance and retention of learned concept. Migalang (2018) and Gambari *et al.* (2017) posits that the use of blended strategy improves students' academic performance, retention and inspires positive attitude towards learning. this study sought to examine the effect of blended learning strategy on students' performance and retention on the concept of chemical combination in secondary schools in UYO Local Government.

## Purpose of study

1. To examine the difference in the mean performance scores of chemistry learners instructed chemical combination using blended instructional strategy and those instructed using expository strategy.
2. To ascertain the interactive effect of gender and instructional strategies on student's achievement on the concept of chemical combination.
3. To compare the mean retention scores of chemistry learners instructed with blended and those taught with expository method.

## Research Questions

1. What is the difference in the mean performance scores of chemistry learners instructed chemical combination with blended instructional method and those instructed with expository method?
2. What difference exists between the mean achievement scores of male and female learners instructed using blended instructional method and those instructed with expository strategy?
3. What is the difference in the mean retention scores of chemistry learners instructed using blended instructional method and those instructed with expository method?

## Statement of Hypotheses

- 1 Mean performance score of learners taught chemical combination using blended method and learners instructed using expository strategy does not differ significantly.
- 2 Gender does not differ significantly with achievement of learners taught chemical combination with blended and expository strategy.
- 3 There is no significant difference in the retention scores of chemistry learners taught chemical combination using blended and expository strategy.

## 2. Literature Review

Senturk (2021) investigated the effect of blended learning on preservice teachers' academic achievement and 21<sup>st</sup> century skills at karamanoglu Mehmetbey university, Turkey. quasi-experimental research design was adopted. performance test and multidimensional 21<sup>st</sup> century skills scale were instruments used, data was analysed using descriptive and standard deviation. The result indicated a statistically significant difference in performance and retention score in favor of the experimental group.

Maccoun (2016) explored effect of blended instructional method on students' achievements and retention among the 5<sup>th</sup> graders in biology in Baghdad. The sample comprised of 60 students grouped into experimental group (30) and control group (30), 30 multiple-choice achievement test items was the instrument used and analysed using ANCOVA. The result indicated a significant difference in performance and retention in favour of the experimental group.

Selvakumar *et al.* (2020) carried out a study on the influence of learning science using blended strategy in India. Quasi-experimental design was adopted with a sample of 60 high school student, science achievement test (SAT) was used as research instrument. Both descriptive and differential analysis were used for data analysis, the findings was significant in favor of the experimental group. The result also showed that blended learning enhanced student retention in science.

Aniefiok and Mfon (2020) examined the effect of blended and expository strategy on senior secondary school student performance on the concept of atomic structure in Eket LGA of Akwa Ibom state. A non-randomized pre-test, post-test quasi-experimental design as used, the study comprised of 153 (66males and 87females) senior secondary 1 student from four intact classes from four co-educational schools in Eket. Achievement test on atomic structure and chemical bonding (ATASCB) was used for data collection and analysed using mean, standard deviation, independent t-test and ANCOVA. The result showed that of the two teaching strategies investigated, blended learning is the most effective in facilitating students' academic achievement and retention in the concept. gender was also found not to be statistically significant.

Oweis (2018), investigated effect of blended strategy on academic performance and motivation to learn English of German Jordanian University students. A pilot case study design, 34 learners purposefully chosen and grouped as control and experimental groups made up sample. Data analysis was done using Analysis of covariance (ANCOVA) and the result was significant in favor of experimental group

Onyenma and Abraham (2020) studied effect of blended strategy on achievement of Physics students in Federal Colleges of Education in South East, Nigeria. 81 students purposively selected from two of the three colleges made up the sample. Electromagnetic Theory Achievement Test (RMETAT), with Reliability coefficient of 0.72 was used to gather data. ANCOVA, Mean, standard deviation were the statistical tool used. The result revealed a significant increased the achievement of Physics students taught using blended strategy but showed no significant in respect to gender.

Onyenma and Olele (2020) studied effect of blended strategy on achievement and retention of Physics students in South East, Nigeria. The sample comprised of 81 students of Federal Colleges of Education were purposively selected from a population of 287. Researcher Made Test of 50 multiple choice objective test with a Reliability index of 0.72. ANCOVA, Mean, and standard deviation were the statistical tool used. The result indicated that blended instructional strategy enhanced retention with gender not been statistically significant

Anari (2021), investigated the effect of blended learning, simulation and expository methods on achievement and interest of senior secondary II Chemistry Students in Calabar education zone of Cross Rivers State, Nigeria. Three hypotheses guided the study. The sample comprised of 150 senior secondary II students selected through purposive sampling technique. Quasi experimental research design was used for the study; the instruments for data collection were Chemistry Performance Test (CPT) and Chemistry Interest Inventory (CII) with a reliability estimate of .78 and .83 respectively. The data were analyzed using ANCOVA and Scheffe's pos t hoc test. The result indicates that the mean achievement and interest of students taught with blended learning strategy was significantly better than those instructed with simulation and expository strategies. The result also showed no significance in the mean achievement and interest scores in respect to gender.

## 3. Methodology

A pretest – posttest quasi-experimental research design was adopted in this study.

### 3.1. Sample and Sampling Technique

A sample of 100 SS II learners made up of 47 boys and 57 girls from two intact classes randomly selected from public secondary schools in the study area. A hat and draw method were used to assign the selected schools into experimental and control groups. The experimental group was taught with blended instructional strategy while the control group was taught using expository strategy.

### 3.2. Instrument for Data Collection

Two instruments were used to collect data namely Chemistry Achievement Test (CAT) and Chemistry Retention Test (CRT). The Chemistry Achievement Test (CAT) contained 25 multiple choice questions all based on the concept of chemical combination. The Chemistry retention test (CRT) was a reshuffled version of the CAT. Each question had four (4) options A, B, C and D with only one correct answer.

### 3.3. Validity and Reliability of the Instruments

The CAT and CRT were submitted to three validates in the Department of Science Education, University of Uyo, and two chemistry teachers teaching in the public schools to cross-check the content and appropriateness of the items considering the students level and the objectives of the study. Reliability of CAT and CRT were ascertained with test-retest method by administering to 20 students in the study area that were not part of the main study and analysed with Pearson Product Moment Correlation (PPMC) to obtained reliability index of 0.81 for CAT and 0.77 for CRT.

### 3.4. Experimental Procedures

The study lasted for 10weeks with 7 weeks for intensive teaching and three weeks for training and administration of pre-test and post-test. The researcher-developed lesson package based on three different topics on the concept of chemical combination that was used to teach the control and experimental group. The research assistant in the experimental group was made to understand and master the features of blended instructional strategy for the concept of chemical combination and the exercises incorporated within it.

Online learning was advanced with the online platform, such as the site of <https://www.talentlms.com>. PowerPoint presentations and relevant video clips were also used. After training, teachers in both experimental and control exposed the students to pre-test followed by teaching for six weeks and then the post- test and subsequently the retention test was administered.

### 3.5. Data Analysis

Data gathered were analysed with ANCOVA, Mean and Standard Deviation.

### 3.6. Answering of Research Questions

Research questions 1 and 2 is answered using the result presented in the Table 1

**Table 1:** Mean and Standard Deviation of Male and Female Chemistry Students' Achievement taught using blended and Expository strategies.

Strategy	N	Pretest		Posttest		Remarks Mean difference
		$\bar{X}$	SD	$\bar{X}$	SD	
Blended	50	3.36	1.14	22.58	1.56	19.22
Expository	50	2.54	0.73	13.20	3.14	10.66
Gender (Blended)						
Male students	19	3.37	1.34	22.84	1.71	19.47
Female students	31	3.35	1.02	22.42	1.48	19.07
Gender (Expository)						
Male students	24	2.63	0.71	13.38	3.59	10.75
Female students	26	2.46	0.76	13.04	2.74	10.58

As shown in Table1, the mean achievement scores of students pre-test and post-test scores taught chemical combination using blended instruction are 2.60 and 21.32 respectively while students taught using expository strategy scored 2.54 and 13.20 respectively. The mean gain scores of 18.72 and 10.66 for students taught using blended and expository strategy respectively indicates that blended instructional

strategy was more effective than expository strategy. The standard deviation of students' pretest and posttest scores taught chemical combination using blended instructional strategy (0.86 and 1.79) and expository strategy (0.73 and 3.14) further reveal that students benefit more in blended instructional strategy than in expository group. Table 1 also indicated that the mean performance scores of male students' pretest and posttest scores instructed using blended learning is 2.59 and 21.07 while that of the female counterparts is 2.61 and 21.61 respectively while male and female students in expository posttest and pretest scores are 2.63 and 13.38 ; 2.46 and 13.04 respectively. From the result blended strategy promote male and female students' academic achievement than the expository strategy.

**Table 2:** Mean, Standard Deviation and Mean Difference of Students' Posttest and Retention Scores Taught Using blended and Expository Strategies.

Strategy	N	Posttest		Retention Test		Mean difference
		$\bar{X}$	SD	$\bar{X}$	SD	
Blended	50	22.58	1.56	21.94	1.83	-0.64
Expository	50	13.20	3.14	10.34	3.12	-2.86

From Table 2, the mean scores of student's post-test and retention scores taught chemical combination using blended instructional strategy are 21.32 and 20.94 while that of students taught using expository strategy are 13.20 and 10.34 respectively. This implies that blended instructional strategy enhanced students' retention than expository strategy.

**Table 3:** Analysis of Variance of the effect of instructional Strategy on achievement of Chemistry Students with Pre-test as Covariate.

Source of Variation	SS	Df	MS	$F_{cal}$	P-value <sub>cal</sub>
Pretest	528.173	1	528.173	88.10*	.000
Strategy	1694.112	1	1694.112	282.59*	.000
Residual	581.51	97	5.995		
Total	2803.790	99	28.321		

\* = Significant at .05 level of significance

The result in Table 3, showed that the calculated P-value (.000) of Strategy is less than the alpha level (.05). Therefore, the null hypothesis is rejected, meaning there is a significant difference in the performance of chemistry learners instructed chemical combination with blended strategy than those instructed using expository method.

**Table 4:** Analysis of Variance of Strategy on Academic Performance of Chemistry Students' Posttest Scores Using Pretest as Covariate Based on Gender

Source of Variation	SS	Df	MS	$F_{cal}$	P-value <sub>cal</sub>
Pretest	528.173	1	528.173	86.721	.000
Strategy	1694.112	1	1694.112	278.129	.000
Gender	2.694	1	2.694	.442	.508
Strategy*gender	.156	1	.156	.026	.873
Residual	581.51	95	5.995	6.091	
Total	2803.790	99	28.321	28.321	

\* = Significant at .05 level of significance

As shown in Table 4, the analysis of the pretest scores of male and female learners instructed with blended and expository strategies was not significant since the calculated P-value (.508) of gender is greater than the alpha level (.05), hence the null hypothesis is retained. implying no significant difference exist between the mean performance scores of male and female learners instructed with blended instructional and expository strategy.



**Table 5:** Analysis of Variance of Students Retention Scores Based on Strategy Using Posttest Scores as Covariate

Source of Variation	SS	Df	MS	F <sub>cal</sub>	P-value <sub>cal</sub>
Posttest	3621.540	1	4453.79	1679.30	.000
Strategy	102.408	1	71.93	27.12	.000
Residual	296.093	97	2.65		
Total	4020.041	99	33.46		

\*=Significant at .05 level of significance

Table 4 showed that the calculated P-value (.000) is less than the alpha level (.05). hence, the null hypothesis is rejected, implying that there exists a significant difference in the mean retention scores of chemistry learners instructed with blended and those instructed using expository strategy.

## 4. Discussion of Findings

The result in Table 1 showed that blended instructional strategy was more effective than expository method in improving achievement of male and female students than expository method. The result is in consonant with that of [Onyenma and Abraham \(2020\)](#), [Anari \(2021\)](#), [Maccoun \(2016\)](#), [Oweis \(2018\)](#) who concluded that blended learning environment had generated a significant difference in students' academic achievement. This better performance by students taught with blended strategy could be due to the active engagement of students in the learning process.

The finding reveals a no significant difference between the mean achievement scores of male and female chemistry learners instructed using blended and expository strategies. This is why [Udousoro \(2011\)](#), supports equality and equity in promoting effective development, utilization of competencies and endowed capabilities of both sexes.

The result indicated a significant difference in the mean retention scores of chemistry learners instructed with blended and those instructed using expository method. The findings of the study is in line with that of [Onyenma and Olele \(2020\)](#), [Senturk \(2021\)](#), [Selvakumar et al. \(2020\)](#) and [Aniefiok and Mfon \(2020\)](#) who found that

Students taught with blended strategy retained significantly higher than students who did not use the strategy. The finding is also in line with [Maccoun \(2016\)](#) who asserted that blended environment aid learning can improve retention.

## 5. Conclusion

Based on the result of the findings, it was determined that **blended learning strategy** improved students' achievement and retention in chemistry.

## 6. Recommendations

1. Blended instructional strategy should be adopted for teaching in secondary school chemistry.
2. Training programs should be organized for secondary school science teachers to acquire knowledge on the use of ICT base strategies.

## References

- Anari, M. I. (2021). Blended Instructional Strategies and Performance of Senior Secondary II Students in Chemistry in Calabar Education Zone, Cross River State, Nigeria. *Prestige Journal of Education*, 4(1): 13-23.
- Aniefiok, I. U. and Mfon, E. U. (2020). Effect of Blended Learning and Expository Instructional Strategies on Senior Secondary School Student's Performance Based on the Concept of Atomic Structure. *International Journal of Multidisciplinary and current Educational Research*, 2(5): 361-71.
- Bazalais, P. and Doleck, T. (2018). Investigating the Impact of Blended Learning on Academic Performance in A First Semester College Physics. *Journal of computers in Education*, 5(1): 67-94.
- Dangwal, K. and Lalima. (2017). Blended Learning: An Innovative Approach. *Universal Journal of Education Research*, 5(1): 129-36.

- Gambari, A. I., Shittu, A. T., Ogunlade, O. O. and Osunlade, O. R. (2017). Effectiveness of Blended Learning and E-Learning Modes of Instruction on the Performance of Undergraduates in Kwara State, Nigeria. *Malaysian Online Journal of Educational Sciences*, 5(1): 25-36.
- Hesse, L. (2017). The Effects of Blended Learning on 12th Grade Students. Unpublished Masters Thesis, University of Northern Iowa. <https://scholarsworks.unit-edu/grp>
- Maccoun, H. S. (2016). The Effect of Using Blended Learning on the Achievement of Students and Information Retention of Fifth Graders in the Biology Course. *Faculty of Education Journal*, 22(95): 209-40.
- McLaughlin, J. E., Gharkholonarehe, N., Khanova, J., Demo, Z. M. and Rodgers, J. E. (2015). The impact of Blended Learning on Students Performance in a Cardiovascular Pharmacotherapy Course. *American Journal of Pharmaceutical Education*, 79(2): 24.
- Migalang, G. (2018). Blended Learning Strategy: Effects on Students Academic Performance and motivation towards Science Disaster Readiness Concept. Unpublished Masters Thesis Central Mindanao University Graduate School.
- Onyenma, C. and Abraham, L. N. (2020). Effect of Blended Learning on Students' Academic Performance In Physics In Federal Colleges of Education In South East. *Nigeria. British Journal of Education*, 8(1): 66-77.
- Onyenma, C. and Olele, C. N. (2020). Effect of Blended Learning on Students' Retention of Physics in Federal Colleges of Education in South East, Nigeria. *International Journal of Education, Learning and Development*, 8(1): 66-76.
- Oweis, T. I. (2018). The Effects of Using A Blended Learning Method on Student's Achievement and Motivation to Learn English in Jordan: A Pilot Case Study. *Education Research International*, 91: 1-7. <https://doi.org/10.1155/2018/7425>
- Selvakumar, S., Sivakumar, P. and Daphine, R. (2020). Leverage of Learning Science Through Blended. *Learning Technique International Journal of Engineering and Advanced Technology*, 9(4): 2051-56.
- Senturk, C. (2021). Effects of the Blended Learning Model on Preservice Teachers Academic Achievements and Twenty First Century Skills. *Education and and Information Technologies*, 26(2): 1-14.
- Udofia, T. M. and Edem, U. P. (2019). Meta-cognitive Strategy and Secondary School Students' Achievement and Retention in Chemistry. *Chemistry and Materials Research*, 11(3): 22-25.
- Udousoro, U. J. (2011). Gender Difference In Computing Participation: The case of University of Uyo. *International Journal of Educational Development*, 2(1): 190-99.