Hybrid Learning, Problem-based and Expository Teaching Strategies on Students' Academic Achievement and Retention in Chemistry in Uyo Local Government Area

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Abstract

This study was carried out to investigate the effect of hybrid learning, problem-based and expository teaching strategies on students' academic achievement and retention in chemistry in Uyo Local Government Area. The study employed a quasi –experimental design with a pretest, posttest non-equivalent control group design. The population of the study consisted of 1844 Senior Secondary School two in Uyo Local Government Area for the 2024/2025 academic session. A sample size of 108 SS2 Chemistry students from 3 intact classes was used as sample for the study. Simple random sampling technique was used in selecting 3 secondary schools out of 14 public secondary schools in the study area. A researcher made instrument tagged: Chemistry Performance Test (CPT) on the concept of environmental pollution was used for data collection. The instrument was validated by two chemistry lecturers in the Department of science education and an expert in Test and Measurement in the Department of Psychological Foundation, University of Uyo for content validation. The reliability of the instrument was determined using Kuder Richardson formula KR-20 and the coefficient obtained was 0.75. Data generated were analyzed using mean and standard deviation and ANCOVA. The results of the findings revealed that there is a significant difference in the mean achievement scores of chemistry students taught environmental pollution using Hybrid Learning (HL), Problem-based (PB) and Expository teaching strategies. Students taught using Problem-based and Hybrid learning group performed significantly better than expository teaching strategy. There is no significant difference between students taught using Hybrid Learning and Problem-based teaching strategies. There is a significant difference in the mean retention scores of Chemistry students taught environmental pollution using HL, PB and expository teaching strategies. In conclusion, HL and PB strategies improve students' academic achievement and retention in the concept of environmental pollution. It was recommended among others that chemistry teachers integrate innovative teaching strategies such as HL and PB for enhancing effective teaching and learning of Chemistry concepts.

Keyword: Hybrid- learning, Problem-based and Expository teaching strategies

Introduction

Countries all over the world are experiencing unprecedented paradigm shifts in educational practices of teaching and learning to be in line with the Millennium goals of the 21st century. In spite of this there is a significant gab in students understanding of the core concepts during classroom lesson delivery. One of the major challenges in teaching and learning lies in the fact that instruction often occurs predominantly at the abstract and symbolic level. Teachers frequently rely on the traditional teaching approaches, which focus heavily on symbolic representations while neglecting the major skills, thus impedes students conceptual understanding and problem solving ability. This challenge is compounded by traditional instructional methods that prioritize rote learning over conceptual understanding and critical thinking. The development of teaching, learning, the use of virtual platforms are being encouraged (Udofia, 2024). Sambo and Udofia 2024 emphasized that the teaching of science at the senior secondary

school levels is about activities (that is learning and doing).The new curriculum in science related courses are being made more activity centered in encouraging the discovery approach with emphasis on students activities.

Hybrid learning, also known as blended learning, is a flexible educational model that systematically combines face-to-face, in-person instruction with online, technology-mediated learning (Udofia, 2024). It is a pedagogical approach that is not simply about using technology in the classroom but about a deliberate and thoughtful design that leverages the unique strengths of both environments. The goal according to Akpan et al (2025) is to create a dynamic and engaging learning experience that provides students with the benefits of direct human interaction while also offering the flexibility, resources and personalization of digital learning. Hybrid learning is a structured and integrated approach to education thatquizzes virtual simulations and asynchronous discussions. This allows for a flipped classroom approach, where students engaged with foundational content independently online, freeing up valuable class time for deeper, more interactive learning. Hybrid learning is distinct from purely online learning (which has no in-person component) and technology-enhanced learning (which uses technology as a supplement to traditional classroom without a structured online component). It is a purposeful blend that seeks to create a continuous and coherent learning experience across different platforms and environments.

Hybrid learning can be defined as an instructional strategy that combined online digital media with conventional teaching method in class room delivery (llo, Alison, Okeke, and Ibe, 2022). Horton (2019) defined Hybrid learning as a combination of advantaged aspect of both web-based learning and in-class learning. The term Hybrid learning is used interchangeably in research literature as personalized learning, differentiated instruction, hybrid learning, technology-mediated instruction, and web-enhanced instruction and mixed- mode instruction. It is a mixture of education that uses technology (high technology such as television, internet and low technology such as emails by voice and conference) with traditional teaching (Smith, 2017). The unique feature of hybrid learning is the ability to use refined techniques from both e-learning and traditional method to produce an output which is the best of each method (Almasaeid, 2014), the interaction involve face to face and online processes, integrated in such a way that the strengths of each blends into unique learning experience that is congruent with the context and the intended outcome. There are numerous advantages of blended learning in teaching and learning of science. Alsalhi, Eltahir and AI-Qatawneh (2019), asserted that Hybrid learning reduces educational costs, increase the number of subjects learned, helps students strive further in particular subjects and allows teachers greater one-on-one relationship with students.

Hybrid learning is seen as an alternative to traditional lecture based course, where various pedagogical approaches are adapted to suit both in-person and online learning environments. This integration of in person and digital learning modalities creates a cohesive and enriched educational experience for students. At its core, hybrid learning aims to capitalities in the strengths of both traditional and digital learning environments, fostering an environment that optimizes student engagement, motivation, and academic achievement. Hybrid learning, a pedagogical approach that integrates traditional face-to-face instruction with online learning activities, has gained substantial recognition and adoption in educational settings. According to recent definitions, Hybrid learning is described as the integration of classroom face-to-face learning experience with online learning experience (Dziuban,

Graham, Moskal, Norberg and Silicia, 2018). The key characteristics of blended learning is its adaptability, allowing for a dynamic combination of in-person and online components to enhance the educational experience.

Additionally, Hybrid learning provided scientific materials to student in a fast, easy and clear manner from various forms of e-learning. It makes group learning possible and each student can advance at his/her own pace. The interaction between the learner and learning materials in electronic environment without the presence of a teacher help students the develop self-learning skills which improve the quality of learning (Taylor, 2017). The learning process becomes fun and attractive since the teacher and the learner represents a major part of blending. , Hybrid learning motivates students to learn on their own, at their own pace and in their own time. Proper implementation of blended learning improves students' success, satisfaction, and retention. Therefore, Hybrid learning improve students' attitude towards learning and increase their level interaction. Furthermore, Hybrid learning combines two learning environment; traditional face-to-face learning and e-learning to meet the evolving needs of new-age learners. Hybrid learning environments provide social interaction and collaboration which is not present in full online systems. In blended learning environment teachers' communication with is direct or indirect, and not limited by time. It 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. However, the success of teaching and learning in science education has been linked to availability of resources and students' reliance on reading (Udofia, Babayemi & Sambo, 2024).

Hybrid learning takes learning out of the walls of the classrooms, making it possible to access resources both online and offline. This helps engage all types of learners both those who learn better in a traditional classroom environment as well as those who work best with semi-autonomous, computer based training (Rajarshi and Nilima, 2020). While classroom learning offers an opportunity for immediate face-to-face interaction, online learning offers self-paced personalized learning with interactive media such as games, videos, tutorials, quizzes, etc. all accessible from the learner's home pages in a learning management system (LMS). In the modern era, numerous studies and research have focused on the design, implementation, and effectiveness of , Hybrid learning models. These studies have contributed to a better understanding of the nuances of blended learning and its impact on student outcomes. Studies have underscored the importance of faculty training and support play a crucial role in optimizing the benefits of blended learning for both instructors and students.

Recent research has also examined the impact of Hybrid learning on student performance and engagement. Uduak and Mary (2021) conducted a comprehensive analysis of online and blended learning outcomes and found that, when designed effectively, Hybrid learning can enhance outcomes and satisfaction. This substantiates the claims that the primary goal of Hybrid learning is to offer student a flexible and personalized learning experience that promote academic achievement. Additionally, Hybrid learning, as defined and researched in recent years, represents an evolving educational approach that combines face-to-face and online learning experiences. The growing body of research and the evolving technology landscape continue to shape the way educators design and implement, Hybrid learning models, with a focus on enhancing students' engagement, performance, and overall learning experience (Frederique, Scott, Clara & Lilibeth, 2020).

Problem-based learning strategy on the other hand is an instructional approach that engages students in addressing and solving real world or hypothetical problems through a structured process. Problem solving is a method of teaching used to accomplish instructional goals of learning basic facts, concepts, and procedures, as well as goals within a problem context (Abasi & Ado, 2021).Problem-solving is an investigative task whereby the solver explores the solution path to reach the goal from given information. Udo (2018) describes problem solving as a cognitive learning strategy which is aimed at bridging the gap between conceptual understanding the phenomena and the representation of the concept. Problem solving involves application of thinking and reasoning to various kinds of problems encountered in life (Abasi & Ado, 2021). It is an integral part of developmental activities and provides opportunities for children to practice what they have learned by applying their learning situations (George & Abasi, 2025). The amount of practice needed by any learner is reduced if he understands the concepts and skills to be practiced. Problem solving is at the very heart of understanding Science (Abasi & Ado, 2021).

Retention is the ability to remember experiences and things learnt, according to Kwanza (2016), retention is the ability of the student to recall what is taught after a given period of time. It encouraged the ability of the student to apply knowledge from lessons in particular situations as a function of recall and conceptualization (Seifertt, 2012). The student retention is affected by a number of factor including instructional techniques, interest, student's activity during lesson, lesson assignment, exercises (Miles, 2015). Student perspective has been recognized as a predictor of their success and retention in science subjects. Alshehri (2016) in a study concluded that there were statistically significant differences in the retention level of students in an experimental group. Hence, students' academic performance is affected by retention only as stated above (Cheng, She and Huang. 2018). It is therefore against this background that this study aims at investigating on hybrid learning, problem-based learning and expository teaching strategies on students' academic achievement in Chemistry in Uyo Local Government Area, Akwa Ibom State.

Statement of the Problem

Students' poor academic performance in SSCE chemistry has attracted a lot of concern from science educators and other stakeholders in Akwa Ibom State. There is a general impression that science education and chemistry in particular is not achieving the desired objectives especially with high incidence of students poor performance in chemistry has caused great fear to students, parent and researcher in Akwa Ibom State. One major challenge facing chemistry teachers is the ability to explore and adopt new innovative teaching strategies that will be attractive to student which will not only increases students' academic performance and retention in chemistry. It is against this background that this study attempts to investigate the effects of hybrid learning, problem-based and expository teaching strategies on students' academic achievement and retention in chemistry in Uyo local government area

Purpose of the Study

The main purpose of this study is to investigate the effect of hybrid learning, problem-based learning and expository teaching strategies on students' academic achievement in Chemistry in Uyo Local Government Area of Akwa Ibom State, Nigeria. Specifically, the study sought to:

1. Determine the main effect of teaching strategies on students' academic achievement in chemistry.
2. Determine the main effect of teaching strategies on students' retention in chemistry.

Research Questions

1. What is the main effect of teaching strategies on students' academic achievement in Chemistry?
2. What is the main effect of teaching strategies on students' retention in Chemistry?

Hypotheses

1. There is no significant main effect of teaching strategies on students' academic achievement in Chemistry.
2. There is no significant main effect of teaching strategies on students' retention in Chemistry.

Methods

This study employed a quasi-experimental design. Specifically, the study employed a pre-test, posttest non-equivalent control group design. The study was conducted in Uyo Local Government Area. The population of the study consisted of 1844 Senior Secondary School Two (SS2) Chemistry students in the 14 public schools in Uyo Local Government Area. Purposive sampling technique was used to select schools/ the sample study comprised 108 students. Schools A, B and C were randomly selected and assigned to Experimental Group 1and 2 while group C serves as control. The instrument for data collection was a researcher made instrument tagged: Chemistry Performance Test (CPT) on the concept of environmental pollution was used for data collection. The instrument was a multiple choice item test with options A-D. The pretest was a general question on chemistry concept while the posttest and retention test contained same questions but different structural arrangement. Lesson plans were prepared for teaching the difficult concept using HL, PB and Expository teaching strategies respectively. The instrument was validated by two chemistry lecturers in the Department of science education and an expert in Test and Measurement in the Department of Psychological Foundation, University of Uyo for content validation. The reliability of the instrument was determined using Kuder Richardson formula KR-20 after administering to 30 students who were not part of the sample size. A reliability coefficient obtained was 0.75 was found and considered acceptable. The researcher sought permission from the respective schools before commencement of the study. The pretest was administered to the three schools to ascertain their pre-entry ability before treatment. The instructional packages were taught to the students in their respective groups after which the posttest was administered to them. Two week after the administration of the posttest, the retention test was administered. The data obtained was analyzed using mean and standard deviation and hypotheses tested using ANCOVA at 0.05 level of significance.

Results

Research question one: What is the main effect of teaching strategies on students' academic achievement in Chemistry?

Table 1: Mean and Standard deviation of the effect of teaching strategies on students' academic achievement

Teaching strategies		Pretest		Posttest		Mean Gain
	N	X	SD	X	SD	
Hybrid Learning	35	55.05	3.76	68.29	6.64	13.24
Problem-based	36	54.75	3.87	60.00	7.27	5.25
Expository	37	54.49	3.81	56.97	5.82	2.48

The result in Table 1 revealed the pretest and posttest mean achievement and standard deviation scores of three groups of students taught using HL, PB and Expository teaching strategies. The posttest and pretest mean scores of 68.29 and 55.05, for those taught using HL, yielded a mean gain score of 13.24.This is followed by the posttest-pretest mean gain scores of 60.00 and 54.75 for those in PB and 56.97 and 54.49 for those taught using expository with mean gain of 5.25 and 2.48 respectively. This result indicates that, students taught using HL had the highest mean achievement scores, followed by those taught using PB. Those taught using expository had the least mean achievement score. Expectedly all the groups had posttest mean scores that are highest than their pretest mean scores. Hence there is effect of teaching strategies on students' academic achievement in Chemistry in favor of Hybrid learning teaching strategy.

Research question two: What is the main effect of teaching strategies on students' retention in Chemistry?

Table 2: Mean and Standard deviation of the effect of teaching strategies on students' retention

Teaching strategies		Posttest		Retention test	
	N	X	SD	X	SD
Hybrid Learning	35	68.29	6.64	69.71	6.17
Problem-based	36	60.00	7.27	61.52	6.84
Expository	37	56.97	5.82	55.00	5.27

The result in Table 2 shows that in posttest, students in HL and PB had a mean score of 68.29 and 60.00 with standard deviation of 6.64 and 7.27 respectively while those in the Expository group had a mean and standard deviation score of 56.97 and 5.82 respectively. In retention mean scores, students taught the concept of environmental pollution in chemistry using HL and PB had a mean and standard deviation of 69.71, 6.17 and 61.52, 6.84 respectively; while those in the expository group had a mean and standard deviation score of 55.00 and 5.27 respectively. This result indicates that there is effect of teaching strategies on students' retention in Chemistry as HL and PB teaching strategies have shown to enhance students' retention of the concept taught more than expository method.

Hypothesis one: There is no significant main effect of teaching strategies on students' academic achievement in Chemistry.

Table 3: Analysis of Covariance (ANCOVA) results on the main effect of teaching strategies on students' academic achievement in Chemistry (N = 108)

SOURCE	Type III sum of Squares	df	Mean Square	F	Sig.
Corrected model	4226.435	3	1408.817	32.094	.000
Intercept	2079.061	1	2079.061	47.363	.000
Pretest	4.884	1	4.884	.111	.739
Teaching Strategies	4222.585	2	2111.293	48.097*	.000
Error	4565.232	104	43.896		
Total	401200.000	108			
Corrected total	8791.667	107			

*Significant @ $p<0.05$ probability level

The result in Table 3 revealed that there is a significant main effect of teaching strategies on students' academic achievement in Chemistry (F_2, 104 = 48.097, p = 0.000) for teaching strategies. Since the p – value is less than the significant value of 0.05 the null hypothesis is rejected. Thus, there is significant main effect of teaching strategies on students' academic achievement in Chemistry in favor of hybrid learning teaching strategy.

Hypothesis two: There is no significant main effect of teaching strategies on students' retention in Chemistry.

Table 4: Analysis of Covariance (ANCOVA) results on the main effect of teaching strategies on students' retention in Chemistry (N = 108)

Source	Type 111 sum of Squares	df	Mean square	F	Sig.
Corrected model	3920.167	3	1306.722	34.655	.000
Intercept	2366.972	1	2366.972	62.773	.000
Pretest	16.616	1	16.616	.441	.508
Teaching Strategies	3920.163	2	1960.082	51.982*	.000
Error	3921.500	104	37.707		
Total	422250.000	108			
Corrected total	7841.667	107			

*Significant @ $p<0.05$ probability level

The result in Table 4 revealed that there is a significant main effect of teaching strategies on students' retention in Chemistry (F_2, 104 = 51.982, p = 0.000) for teaching strategies. Since the p – value is less than the significant value of 0.05 the null hypothesis is rejected. Thus, there is significant main effect of teaching strategies on students' retention in Chemistry.

Discussion of Findings

The analysis of the results on the main effect of teaching strategies on students' academic achievement and retention in chemistry when taught the concept of environmental pollution showed that students in Hybrid learning group achieved academically higher than those in problem-based and expository group, while Problem-based group performed higher than those in Expository group. This implies that treatment offered played a key role in improving students' academic achievement in chemistry. These findings support the finding of different researchers (Udofia, 2024, Sambo, 2024, Akpan, 2025).These findings opined that ineffective teaching strategies adopted in teaching chemistry, often leads to poor academic achievement and retention.

Conclusion

It is evident from the findings of this study that the use of Hybrid learning teaching strategy is more effective in facilitating and enhancing students' academic achievement and retention in Chemistry than problem-based and expository strategies. By implication, this affirmed that teaching strategies are also a determinant of students' academic achievement and retention in chemistry.

Recommendations

Based on the conclusion of this study, the following recommendations are made:

1. Teachers should adopt hybrid learning and problem-based teaching strategy in teaching the concept of environmental pollution and other concepts in chemistry instead of using the expository method as this strategy will help them to achieve the stated objectives of the lesson and subsequently enhance students' academic achievement and retention in chemistry.
2. Hybrid learning strategy should be enriched more with problem-based strategy as it will also help the students in a way that would enable them learn concepts in chemistry effectively and diagnose learning difficulties in various ways.

References

Abasi, A. U. & Ado, I. B. (2021). Effect of problem-solving method on secondary school students' academic achievement and attitude in mathematics in Uyo Local Government Area of Akwa Ibom State. *The Journal of Mathematical Association of Nigeria,* 46(1) 342-352.

Akpan, Anyanime O. Atabang, Atim A. & Udofia, Sabbath E. (2025). Online learning platforms and bridging of digital knowledge gap among postgraduate students in Akwa Ibom State. *International Journal of Education Framework (IJEFA)* 5(1) 43 – 56.

Almasacid, D. (2014). Effect of guided discovery method of instruction and students' achievement in chemistry at the secondary school level in Nigeria. *International Journal of Scientific Research and Education*, 5(2), 6226-6234.

Alsalhi, A. Eltahir D. & Al- Qatawnch (2019). Teacher method of teaching and student academic achievement in Basic science and technology in junior secondary schools in south-west, Nigeria. *Journal of Education and Research,* 4(3), 397-402.

Alshehri B. (2016). *Developing critical thinking and problem- solving abilities*. Jossey-Bass.

Cheng, She & Huang (2018). Integrated green conception into applied science course assessing Taiwan students' learning attitude and correlation analysis. *Interdisciplinary Journal of Environmental and science Education*, 18(1), 23-34.

Dziuban, Graham, Moskal, Norbery&Silicia (2018). Teaching methodology in basic science and technology classes in south-west Nigeria. *Asian Journal of Education,* 1 (4), 206-214.

Frederique, Scott, Clara & Lilibeth (2020). *Integrating educational technology into teaching*. Merrill prentice Hall.

George, I. & Abasi, A. U. (2025). Problem solving instructional strategy and mathematics students' performance in integral calculus in Mkpat Enin Local Government Area, Akwa Ibom State. *Inter-Disciplinary Journal of Science Education (IJ-SED),* 6(1) 18-25.

Horton, A. (2019). Strategies and utilization of improvised biology of instructional materials and students' achievement and attitudes in Ekiti State secondary schools, Nigeria.*International Journal of Research in Education.* 3(2), 42-56.

Ilo, Alison, Okike & Ibe (2022). Effects of instructional strategies on chemistry students' performance in secondary schools in Osisioma Ngwa local government Area, Abia State. *Trends in Educational Studies (TRES)* 11(3). 164-175.

Miles (2015). Effect of teaching relevant mathematical topics before and during the teaching of selected topics in chemistry.Unpublished MSc Thesis. Department of science Education, Nnamdi Azikiwe U university, Awka.

Rajarshi & Nilima (2020) Digital storytelling: A powerful technology tool for the 21st- century classroom. The collage of education and human ecology. *The Ohio State University*, 47(3), 220-228.

Sambo, Davis D. & Udofia, S. (2017). Integrating artisan skills development into teacher education curriculum in tertiary education: A means of eradicating poverty. *Knowledge Review: A Multidisciplinary Journal* 36(2) 88-95

Seifertt (2012). Strategies for science teaching and learning. Retrieved 12th April 2018 from http://www. Scienceuniverseedu. Cu\school\support\strategy html.

Smith C. (2017). Gender difference in Nigeria junior secondary students' academic achievement in Basic Science. *Journal of Educational and social research*, 2(1), 93-99.

Taylor (2017). The effects of problem-based learning and learning motivation of mathematical problem-solving skills of class 5 students at SDN 0407 Mondang. BirLE. 3, 531-539.

Udo (2018). Problem based learning in mathematics. ERIC Clearing house for science mathematics and Environmental Education.

Udo, M. E. (2018). Effects of problem-solving, guided discovery and expository teaching strategies on students' performance in redox reactions. *International multi-disciplinary Journal*, 5(4), 231-241.

Udofia, S. E. (2024). Effectiveness of vista demonstration learning strategies on students' achievement in chemistry, *Ibadan Journal of Education Studies (IJES)* 2(142), 63-71.

Udofia, S. E., Babayemi, J. O. & Sambo, D. D. (2024). The extent of utilization of zoom machines in science lessons deliveries among science lecturers in Akwa Ibom State tertiary institutions. *Journals of Education, University of Uyo*, 13(1), 236 – 244.

Uduak and Mary (2021)..Effect of using problem solving method in teaching mathematics on the achievement of mathematics students. *Asian Social Science Journal*, 67, 12-18.