Unizik Orient Journal of Education (UNIOJE), Vol. 12, No. 1, December, 2025.
----------ISSN: 0794-9525----------

ADVANCING THE USE OF INNOVATIVE TEACHING METHOD IN AN AGE OF ARTIFICIAL INTELLIGENCE: IMPACT ON STUDENTS INTEREST IN LEARNING CHEMISTRY

Juliana N. Nnoli. (Ph.D)[1]; Joy A. Eke (Ph.D)[2]; Emmanuel N. Okwuduba (Ph.D)[3]
Okonkwo Ifeoma Georgina (Ph.D)[4] & Nwune Emmanuel C[5]
[1]jn.nnoli@unizik.edu.ng+2348036736987; [2]ja.eke@unizi.edu.ng +2348120227166;
[3]en.okwuduba@unizi.edu.ng +2348067467016; 4ig.okonkwo@unizik.edu.ng
+2348037189552 [5]ce.nwune@unizi.edu.ng +2349038623739

ABSTRACT
The study investigated the impact of innovative teaching method in an age of artificial intelligence on senior secondary school students' interest in learning Chemistry in Awka South Local Government Area. Five research questions guided the study. The study adopted descriptive survey research design. The population of the study comprised all the 1009 senior secondary school two chemistry students in the 19 public secondary schools in Awka South Local Government Area of Anambra State. The sample size was 151 SS2 chemistry students selected through simple random technique. The instrument used for data collection was forty questionnaire designed by the researchers titled 'Impact of Innovative Teaching Method on the Interest of Senior Secondary School Students in Learning Chemistry Questionnaire" (IITMISSSSLCQ). The questionnaire was validated by three experts, two from the department of science education, and one from educational foundations, all from Nnamdi Azikiwe University, Awka. Cronbach Alpha was used to obtain overall reliability estimate of 0.86.Data obtained was analyzed using mean and standard deviation. The findings showed that in an age of mimic's functions, some innovative teaching methods have positive impact on senior secondary school students' interest in learning Chemistry in Awka South Local Government Area. It was concluded that innovative teaching methods have positive impact on senior secondary school students' interest in learning Chemistry notwithstanding the mimics' functions of this age in Awka South Local Government Area. It was recommended that Chemistry teachers should incorporate innovative teaching methods into their curriculum to increase students' interest and motivation in learning chemistry more especially in this new age of artificial intelligence.

KEYWORDS: Advancing, Innovative Teaching Method, Artificial Intelligence, Impact, Student's Interest and Learning Chemistry**.**

Introduction

Artificial Intelligence (AI) is a term used to describe computers and other devices that are designed to think in a manner similar to humans. The capacity of these ingenuous devices to gather data from the environment would allow for fine-tuning any intelligent system by making a record of an incident with its devices (Julius, 2025). AI mimics' functions that human associate with human though processes. In other words, AI is a significant advancement in computing technology, which involves creating machines that can replicate human abilities like learning, reasoning and understanding scientific languages.

Science is regarded as a means of providing explanations to various natural phenomena and events making essential for human development (Iwu, 2021). Therefore, there's need for effective science and technology education of the learner. For this reason, Science Teachers Association of Nigeria (STAN) often hold workshops, seminars and conferences for science teachers, geared towards improving the methods of teaching science subject and marking them interested to students more particularly in secondary schools in order that the teaching will not be affected by any mimic human learning.

Chemistry is the study of matter and the relationship that exists between them. It is process of acquiring the fundamental knowledge about the universe. It is sometimes called the "central science" because it connects physical science with the life sciences and applied sciences such as medicine and

Engineering (Ngawang and Norbu 2021). Chemistry is a science that systematically studies composition, properties and activities of organic and inorganic substances and various elementary forms of matter (Nnoli, 2024). It is a vehicle through which chemical knowledge and skills reach the people who need capacity and potential for development (Okeke and Okey, 2018). The teaching and learning of chemistry as in the case of other science subjects has tremendous role towards industrialized in this age of artificial intelligence, technological developments in developing country. It shows how facts are established by experiment and observation, how generalization are built upon, how knowledge and concepts developed (Omeodu, 2023). The 20th century saw dramatic advances in the comprehension of the marvelous and complex chemistry of living organisms, and a molecular interpretation of chemistry and disease holds great promise (Okon, 2017). To teach chemistry effectively requires the help of skilled and knowledgeable experts with innovative teaching methods who can help students become active participants in discovering knowledge in their teaching and learning environment.

Innovation is the act of constructive thinking, group knowledge, skills and attitude into, new, original and rational ideas. It is an approach that involves the use of technology, hands-on activities and other materials to help stimulates student learning capability. Education innovation is a deliberate, conscious or unconscious psychological, social, scientific and philosophical process that aims to maximize societal growth as well as the greatest possible development for each person (Nnoli, 2023). It is an intentional endeavor aimed at accomplishing specific objectives, particularly the dissemination of information. It is also a dynamic and diverse field which shows the right direction to explore, encompassing various domains and disciplines each with its own objectives. It breaks away from traditional teaching strategy to engage students in New and more effective ways of learning. According to Osuala (2021), innovative teaching method looks deeply into what students really acquire from what was taught in the class or the activities involved in the teaching. It is prioritize student-centered learning, active engagement, and the integration of technology. These methods aim to foster critical thinking, creativity, collaboration, and problem-solving skills among students (Offor & Offiah, 2023). By leveraging technology and real-world applications, innovative teaching methods seek to make learning more interactive, relevant, and engaging for students. The use of innovative teaching method in schools has the potential not only to improve education but to empower people, strengthen governance and galvanize the effort to achieve the human development goal (Jayalaxmi, 2020).

There are different types of innovative teaching methods; they include computer-based learning (CBL), project-based learning (PBL), collaborative learning, flipped classrooms, personalized learning, gamified learning, and experiential learning. Computer-based learning (CBL) is an educational approach that utilizes computers and digital technology to deliver content and facilitate learning experiences (Oguezue, 2025). It encompasses a wide range of applications, from using software for interactive lessons and simulations to employing virtual reality for immersive learning. CBL can be used in various settings, including traditional classrooms and remote learning environments, offering students a dynamic and flexible way to engage with educational materials (Pius, Nnoli and Onigwe, 2023).

Project-based learning, as discussed by Thomas (2020), involves students working on real-world projects that require critical thinking, problem-solving, and creativity. This approach helps students develop deeper learning outcomes and prepares them for future careers. Collaborative learning, as emphasized by Johnson and Johnson (2020), encourages students to work together to achieve common goals. This approach fosters teamwork, communication, and social skills, leading to improved learning outcomes.

Flipped classrooms, as described by Egbon (2017), involve reversing the traditional lecture-homework format. Students learn basics at home and work on activities and projects in class, promoting active learning and increased engagement. Personalized learning, as explained by Ezeudu (2018), tailors learning experiences to individual students' needs, interests, and abilities. This approach uses technology and data to provide targeted support and improve student outcomes.

Gamified learning, as discussed by Usselman and Rocky (2024) incorporates game design elements into learning experiences. This approach increases motivation, engagement, and fun, leading to improved learning outcomes.

Experiential learning, as emphasized by Adebayo (2018) involves hands-on experiences that allow students to apply theoretical concepts to real-world situations. This approach helps students develop practical skills and deepens their understanding of subject matter. By incorporating these innovative approaches, educators can create engaging, effective, and student-centered learning environments that prepare students for success; hence making the learning of chemistry effective in the 21st century.

Learning is the acquisition of knowledge or skills through study, experience, or being taught. Learning is a process that leads to change, which occurs as a result of experience and increases the potential for improved performance and future learning (Ambrose, 2019). In the context of this study, learning is the process by which students acquire and retain attitudes, knowledge, understanding and skills capabilities that cannot be attributed to inherited behavior pattern or physical growth. The change in the learner may happen at the level of knowledge, attitude or behavior and could be easily achieved among chemistry students during teaching-learning process using innovative teaching methods. Innovative teaching method in education according to Nwankwo (2022) are the broader techniques that could be used to help boost student interest in mastering the content of a subject and achieving learning outcome.

The traditional teaching methods employed in chemistry classrooms seem inadequate to address this issue of poor performance in chemistry, leaving educators searching for innovative approaches to rekindle students' passion for learning chemistry (Adebayo, 2018). Also, the underrepresentation of female students in chemistry-related careers and their consistently lower performance in chemistry exams in Awka South Local Government Area suggests a persistent gender gap in chemistry education. Innovative teaching methods have been touted as a potential solution, but their impact on senior secondary school students' interest in learning chemistry, particularly across genders, remains unknown (Wilson, 2021). More so, the effectiveness of these innovative methods in Awka South Local Government Area remains unexplored, particularly regarding their impact on gender differences in students' interest in chemistry. Hinged on these, this study is being conducted to examine the impact of innovative teaching method in this age of artificial intelligence on Senior Secondary school student's interest in learning Chemistry in Awka South Local Government Area.

Statement of the Problem

The decline in students' interest in learning chemistry in this era of artificial intelligence at the senior secondary school level has become a significant concern for educators, researchers and policymakers. Traditional teaching methods, which often rely heavily on rote memorization and didactic instruction, have been identified as a contributing factor to this problem at this AI age. These conventional approaches frequently fail to engage students or stimulate their curiosity and enthusiasm for the subject more especially now where one can create machines that can replicate human abilities. Again, people are accustomed to learning quickly in this era of mimic's functions through AI. Therefore, students, particularly females, should restrict from showing declining interest in learning chemistry by introducing/ integrating a more innovative method or technology-enhanced learning (TEL) paradigm, which supports a blended solution that mixes the use of technology with traditional techniques and fostering the learning process. Hence, the gender-based impact on students' interest in chemistry remains unexplored where there is negligence of some innovative teaching methods, such as computer-based learning, project-based learning, collaborative projects, the integration of technology, and hands-on experiments, which have been proposed as potential solutions to enhance student engagement and interest in chemistry.

Purpose of the Study

The purpose of this study is to examine the impact of innovative teaching method on senior secondary school students' interest in learning chemistry in Awka south local government area. Specifically, the study seeks to investigate the:

1. Impact of computer based learning on senior secondary school students' interest in learning chemistry in Awka south local government area.
2. Impact of project based learning on senior secondary school students' interest in learning chemistry in Awka south local government area.
3. Impact of collaborative learning on senior secondary school students' interest in learning chemistry in Awka south Local government area.
4. Impact of flipped classroom on senior secondary school students' interest in learning chemistry in Awka south local government area.
5. Impact of experiential learning on Senior Secondary school students' interest in learning chemistry in Awka south local government area.

Research Questions

These research questions guided this study:

1. How does computer based learning impact senior secondary school students' interest in learning chemistry in Awka south local government area?
2. How does project based learning impact senior secondary school students' interest in learning chemistry in Awka south local government area?
3. How does collaborative learning impact senior secondary school students' interest in learning chemistry in Awka south local government area?
4. How does flipped classroom impact senior secondary school students' interest in learning chemistry in Awka south local government area?
5. How does experiential learning impact senior secondary school students' interest in learning chemistry in Awka south local government area?

Methods

The design used for this study was descriptive survey design. This study was conducted in Awka South Local Government Area, Anambra State, Nigeria. The population of the study comprised all the 1009 SS2 chemistry students in the 19 public secondary schools in Awka south local government area of Anambra State. The sample size was 151 SS2 chemistry students. Out of the 19 public secondary schools in the study area, simple random sampling technique was used to select four (4) co-education secondary schools. The research instrument for the study was a questionnaire, designed by the researchers. The instrument was titled "Impact of Innovative Teaching Methods on the Interest of Senior Secondary School Students in Learning Chemistry Questionnaire" (IITMISSSSLCQ). The instrument consists of two sections A and B. Section A sought information on respondents' personal data, while section B contained 40 items that sought information required to answer the research questions. Very importantly, section B contains items in three subsections which were structured on a four point rating scale of Strongly Agree (SA) =4, Agree (A) =3, Disagree (D) =2 and Strongly Disagree (SD) =1. The essence was to ensure that the researcher evaluated properly the topic under study. To ensure the validation of the instrument, the researcher submitted the instrument alongside with the title of the study, purpose of the study, scope of the study and research questions to three experts, two in the department of science education and the other expect in the department of educational foundations, all in the Faculty of education, from Nnamdi Azikiwe University Awka. The researcher appealed to the experts to validate the instrument in terms of language clarity, relatedness and average of the items to the purpose of the study and clarity of the instructions and to freely suggest modifications as they deem necessary. The corrections suggested by experts led to such modifications such as correction in the instructions, recasting, removal and addition of some items which led to increase in the number of items in the final version of the instrument. Cronbach alpha method was used to establish the reliability of the instrument as 0.86. The instrument was administered to the respondents by the researchers with the help of 2 research assistants who are duly trained on how to administer the questionnaire politely. The instrument was administered during teaching and learning periods by direct delivery method in the selected schools. Data obtained was analyzed using mean and standard deviation. A mean of 2.50 was used as the cutoff point for making decisions. The decision rule was that any item that scored a mean of 2.50 and above will be seen as having attracted positive responses and is agreed, while items that scored less than 2.50 was regarded as having attracted negative responses and is disagreed.

Research Question 1

How does computer based learning impact senior secondary school students' interest in learning chemistry in Awka south Local government area?

Mean rating of respondents on impact of computer based learning on Senior Secondary school students' interest in learning chemistry in Awka South Local Government Area

S/N	Questionnaire Items	Meann	SD	Remark	SD	Remark
1.	CBL analyzed data and encourages active learning among chemistry students	2.94	1.81	Agreed	1.81	Agreed
2.	CBL connects chemistry concepts to real-world scenarios	2.88	1.78	Agreed	1.78	Agreed
3.	CBL helps chemistry students develop essential skills in critical thinking	2.82	1.76	Agreed	1.76	Agreed
4.	CBL encourages chemistry students to think creatively and develop innovative solutions	2.87	1.77	Agreed	1.77	Agreed
5.	CBL helps chemistry students take ownership of their learning and understands artificial intelligence	2.90	1.73	Agreed	1.73	Agreed
6.	CBL is easily accessible and promotes teamwork among chemistry students	2.80	1.84	Agreed	1.84	Agreed
7.	CBL shows students how chemistry applies to everyday life	2.68	1.61	Agreed	1.61	Agreed
8.	CBL does not encourage research which promotes students interest in Chemistry.	2.74	1.67	Agree	1.67	Disagree
9.	CBT offers interactive elements like quizzes, simulations and games to reinforce learning.	2.84	1.70	Agreed	1.70	Agreed
	Cluster Mean	2.89	1.74	Agreed	1.74	Agreed

This showed that 9 items (1, 2, 3, 4, 5, 6, 7, 8 and 9) had mean score above the cut-off point of 2.50 indicating agreed. However the cluster mean of 2.89 was used to conclude that computer based learning has positive impact on senior secondary school students' interest in learning chemistry in Awka south local government area.

Research Question 2

How does project based learning impact senior secondary school students' interest in learning chemistry in Awka south Local government area?

Mean rating of respondents on impact of project based learning on Senior Secondary school students' interest in learning chemistry in Awka South Local Government Area

S/N	Questionnaire Items	Mean	SD	Remark	SD	Remark
10.	PBL encourages active learning among chemistry students	2.90	1.70	Agreed	1.70	Agreed
11.	PBL connects chemistry concepts to real-world scenarios	2.80	1.67	Agreed	1.67	Agreed
12.	PBL does not help chemistry students develop essential skills in critical thinking	2.76	1.66	Agreed	1.66	Agreed
13.	PBL encourages chemistry students to think creatively and develop innovative solutions	2.80	1.67	Agreed	1.67	Agreed
14.	PBL helps chemistry students take ownership of their learning	2.92	1.71	Agreed	1.71	Agreed
15.	PBL does not promotes teamwork among chemistry students	2.86	1.69	Agreed	1.69	Agreed
16.	PBL shows students how chemistry applies to everyday life	2.61	1.61	Agreed	1.61	Agreed
17.	PBL does not encourage research which promotes students interest in Chemistry	2.84	1.67	Agreed	1.67	Agreed
	Cluster Mean	2.81	1.68	Agreed	1.68	Agreed

This showed that 8 items (10, 11, 12, 13, 14, 15, 16 and 17) had mean score above the cut-off point of 2.50 indicating agreed. However the cluster mean of 2.81 was used to conclude that project based learning has positive impact on senior secondary school students' interest in learning chemistry in Awka south local government area.

Research Question 3
How does collaborative learning impact senior secondary school students' interest in learning chemistry in Awka south local government area.

Mean rating of respondents on impact of collaborative learning on senior secondary school students' interest in learning chemistry in Awka south Local government area

S/N	Questionnaire Items	Mean	SD	Remark
18.	Collaborative learning does not encourage chemistry students to engage actively with chemistry concepts	2.94	1.71	Agreed
19.	Collaborative learning creates a supportive environment where chemistry students work together	2.92	1.70	Agreed
20.	Collaborative learning does not help chemistry students develop essential communication skills	2.98	1.72	Agreed
21.	Collaborative learning does not allow chemistry students to teach and learn from each other	2.93	2.93	Agreed
22	Collaborative learning helps chemistry students feel more connected and motivated	2.66	1.63	Agreed
23	Collaborative learning chemistry promotes critical thinking	2.36	1.53	Disagreed
24	Collaborative learning prepares chemistry students for future careers	2.94	1.71	Agreed
25	Collaborative learning does not make chemistry more enjoyable and interactive for students	2.76	1.66	Agreed
	Cluster Mean	2.81	1.67	Agreed

This showed that 7 items (18, 19, 20, 21, 22, 23, 24 and 25) had mean score above the cut-off point of 2.50 indicating agreed whereas one item (14) where rated disagreed. It shows that collaborative learning has positive impact on senior secondary school students' interest in learning chemistry in Awka south local government area.

Research Question 4
How does flipped classroom impact senior secondary school students' interest in learning chemistry in Awka south Local government area.

Mean rating of respondents on impact of flipped classroom on Senior Secondary school students' interest in learning chemistry in Awka south local government area

S/N	Questionnaire Items	Mean	SD	Remark
26.	Flipped classrooms does not allow students to learn at their own pace, reviewing material before class	2.89	1.70	Agreed
27.	Flipped classrooms does not encourage active learning, making chemistry more engaging and interactive.	3.38	1.83	Agreed
28	Students develop a stronger foundation in chemistry concepts, leading to improved understanding and retention.	2.93	1.73	Agreed
29.	Flipped classrooms promote critical thinking, problem-solving, and analysis, essential skills for success in chemistry	2.57	1.60	Agreed
30	Flipped classrooms allow teachers to provide targeted support and feedback, addressing individual students' needs and misconceptions	2.67	1.63	Agreed
31	Flipped classrooms often utilize online resources, providing students with additional support and learning materials..	2.79	1.67	Agreed
32	Flipped classrooms does not make learning chemistry more enjoyable, interactive, and relevant, increasing students' interest	2.83	1.68	Agreed
	Cluster Mean	2.86	1.69	Agreed

This showed that 7 items (26, 27, 28, 29, 30, 31 and 32) had mean score above the cut-off point of 2.50 indicating agreed. It shows that flipped classroom has positive on Senior Secondary school students' interest in learning Chemistry in Awka South Local Government Area.

Research Question 5

How does experiential learning impact senior secondary school students' interest in learning chemistry in Awka south local government area.

Mean rating of respondents on impact of experiential learning on senior secondary school students' interest in learning chemistry in Awka south local government area

S/N	Questionnaire Items	Mean	SD	Remark
33	Collaborative learning does not encourage chemistry students to engage actively with chemistry concepts	2.86	1.69	Agreed
34	Collaborative learning creates a supportive environment where chemistry students work together	3.21	1.79	Agreed
35.	Collaborative learning does not help chemistry students develop essential communication skills	2.94	1.71	Agreed
36.	Collaborative learning does not allow chemistry students to teach and learn from each other	2.65	1.62	Agreed
37.	Collaborative learning helps chemistry students feel more connected and motivated	2.85	1.68	Agreed
38	Collaborative learning chemistry promotes critical thinking	2.93	1.71	Agreed
39	Collaborative learning prepares chemistry students for future careers	2.76	1.66	Agreed
40.	Collaborative learning does not make chemistry more enjoyable and interactive for students	2.67	1.63	Agreed
	Cluster Mean	2.85	1.68	Agreed

This showed that all the respondents agreed to the 8 items (33-40), it shows that experiential learning has positive impact on senior secondary school students' interest in learning chemistry in Awka south local government Area.

Discussion of Findings

The findings of the study showed that computer based learning has positive impact on senior secondary school students interest in learning chemistry in Awka south local government area. Computer-based learning, which enhances learning experiences by providing interactive and accessible educational resources, was found to significantly increase students' interest in chemistry. To support this result, Oguezue (2025), posited that project-based learning fosters deeper learning, critical thinking, and problem-solving skills, leading to improved academic outcomes**.**

Project based learning has positive impact on senior secondary school students' interest in learning chemistry in Awka south local government area. This is because students learns skills through projects. To support this result, Thomas (2020), posited that project-based learning fosters deeper learning, critical thinking, and problem-solving skills, leading to improved academic outcomes.

Collaborative learning, which involves students working in groups to achieve a common goal, was also found to have a positive impact on students' interest in chemistry in Awka south local government area. This finding is in consonance with the findings by Johnson and Johnson (2020) who reported that collaborative learning promotes social interaction, teamwork, and communication among students, leading to improved learning outcomes

Flipped classroom has positive impact on senior secondary school students' interest in learning chemistry in Awka south local government area. According to Adebayo (2020), flipped classrooms increase student engagement, motivation, and understanding of subject matter

Experiential learning has positive impact on Senior Secondary school students' interest in learning Chemistry in Awka South Local Government Area. This is because students learns faster by observations. To support this result, Kolb and Kolb (2020), agreed that experiential learning allow students to apply theoretical concepts to real-world situations. This approach helps students develop practical skills and deepens their understanding of subject matter; hence making the learning of chemistry effective in this age of artificial intelligence.

Conclusions

Based on the findings of the study, it was concluded that innovative teaching methods stimulates the curiosity and enthusiasm of chemistry students more especially now where one can create machines that can mimic human abilities (AI). Integrating a more innovative method or technology-enhanced learning (TEL) paradigm, supports a blended solution that mixes the use of technology with traditional techniques, thereby, fostering the learning process towards improving students' learning experience. Secondly, innovative teaching method when integrated into the classroom will support teachers virtual experience, helps students experience learning where they cannot access classrooms and finally helps teachers becomes a facilitators instead of instructors. Hence, innovative teaching method, if effectively implemented, notwithstanding the mimics' functions that humans associates with human thought processes, in Awka South Local Government Area, the teaching and learning of chemistry will be very interesting and the abstract nature minimized.

Recommendations

Based on the findings of the study, the following recommendations were made:

1. Incorporation of more innovative method into science curriculum like, technology-enhanced learning (TEL) paradigm, that mixes the use of technology with traditional techniques, thereby, fostering the learning process towards improving students' learning experience and motivation in learning chemistry.
2. Educators should collaborative science learning environments by making emotionally safe micro cultures in the classroom that invite all students with divert strength and weaknesses to explore together challenging science concepts for which justice and sustainability represent powerful driving goals for inquiry.
3. Personalized science learning experiences by emerging artificial intelligence technology that can support the collaborative interest of science learning experiences.
4. Chemistry teachers should incorporate interactive and hands-on activities in classroom settings to sustain students' interest in chemistry, building on their natural inclination towards experimentation and exploration.
5. Incorporation of experiential learning approach to create a more engaging and effective learning environment that fosters students' enthusiasm and motivation to learn chemistry.

REFERENCES

Adebayo, S. (2020). Flipped classrooms and collaborative learning: A review of the literature. *Journal of Educational and Social Research*, 8(2), 15-27.

Ambrose, P. A. (2019). Collaborative learning: A review of the literature. *Journal of Educational Research,* 111(4), 441-451.

Egbon, P. O. (2017). Collaborative learning and academic achievement of secondary school students in Nigeria. *Journal of Educational Research and Review*, 5(2), 27-35.

Ezeudu, F. O. (2018). Experiential learning and the development of essential skills. *Journal of Educational Research and Practice*, 7(1), 1-10.

Iwu, N. S. (2021). Experiential learning and academic achievement in STEM subjects. *Journal of Educational Research and Review*, 6(3), 24-33.

Jayalaxm, M. A. (2020). The flipped classroom: A review of the literature. *Journal of Educational Technology Development and Exchange*, 12(1), 1-23.

Johnson N. & Johnson, C. J. (2020). Flipping the classroom: A review of the literature. *Journal of Educational Research,* 112(4), 441-451.

Julius, E. A. (2025). Re-imagining Science Education in the Age of Artificial Intelligence. Memorial Lecture on 65th Annual Conference Proceedings of STAN 8-18.

Matt, N. P. (2023). Collaborative learning and academic achievement of Nigerian students: A review of literature. *Journal of Educational Research and Practice*, 8(1), 1-13.

Ngawang N. & Norbu, K. (2021). The flipped classroom model: A comprehensive review. *Journal of Educational Technology Development and Exchan*ge, 12(1), 1-24.

Nnoli J. N (2023) Identifying the process skills involved in teaching chemistry through the extraction from castor oil seed. *Journal of chemistry studies* 1(6) 1-4

Nnoli J. N (2024) Enhancing senior secondary school students academic performance in chemistry through the implementation of think-pair-share strategy. *Journal of social education research*. 370-379.

Nwankwo, C. M. (2022). Experiential learning and the development of essential skills. *Journal of Educational and Social Research*, 8(2), 28-35.

Offor, U. I. Offiah, C. (2023). Consequences of Monday sit at home protest on academic performance of secondary school students in Anambra State. *Unizik Journal of Educational Research and Policy Studies 15(2), 201-210 https://unijerps.org*

Okeke N. I. & Okey H. J. (2018). Flipped classrooms and student learning outcomes: A systematic review. *Journal of Educational Technology Development and Exchange*, 12(2), 1-22.

Okon, S. A. (2017). Experiential learning and Met cognition. *Journal of Educational Research*, 112(4), 451-461.

Omeodu A. (2023). Exploring the impact of flipped classrooms on female students' interest in STEM subjects. *Journal of Women and Minorities in STEM*, 23(1), 1-15**.**

Osuala, S. (2021). Project-based learning and the achievement gap. *Journal of Educational Research*, 111(4), 432-441.

Pius, P. O, Nnoli, J.N. & Onigwe, B. U.(2023). Gender and Academic Retention of Secondary School Students Taught Radioactivity with Computer Animated Instructional Package in Ogidi Education Zone Unizik *Journalof Education Research* 16, (5) 2136.

Thomas, A. S. (2020). Motivating project-based learning. *Journal of Science Education and Technology*, 26(1), 1-13.

Usselman N. & Rocky, J. A. (2024). Flipped classrooms and critical thinking skills in Nigeria. *Journal of Educational and Social Research*, 8(2), 1-12.

Wilson D. A. (2021). Experiential learning theory: A dynamic, holistic approach to learning. *Journal of Educational Research and Practice*, 8(1), 1-13.