Kogi Journal of Education and Pedagogy (KOJEP), Vol. 4, No. 1, JUNE, 2025

ISSN 2736-0091
E-ISSN 2737-0107

IMPROVING ACADEMIC PERFORMANCE OF STUDENTS IN HEAT ENERGY THROUGH ENRICHED DEMONSTRATION STRATEGY

BY

Fasanya, Ayodele Gabriel: Department of Science Education, Faculty of Education, Prince Abubakar Audu University, Anyigba, Kogi State; E-mail: fasanya798@gmail.com/fasanya@ksu.edu.ng

&

Arivi, Saliu Sadiq: Department of Science Education, Faculty of Education, Prince Abubakar Audu University, Anyigba, Kogi State

Abstract

The study examined the effectiveness of enriched demonstration teaching strategy on academic performance of senior secondary school students in heat energy in Dekina Local Governments Area, Kogi State. To achieve this objective, two research questions and two hypotheses were formulated to guide the study. Quasi experimental design was adopted for the study. The population comprised the 27 public senior secondary schools in the study area with 1150 Senior Secondary two (SS2) students offering Physics during the 2024/2025 academic session. The sample size for the study was 100 students comprising of 60 male and 40 female from three intact classes in three public secondary schools, which were selected using purposive sampling technique. The instrument used for data collection was well-structured Physics Performance Test (PPT), which was validated by three experts in test and measurement and Physics education. The internal consistency of the instrument using Kuder Richardson 20 (KR_{20}) formula was 0.81. The data obtained from the study were analyzed using descriptive and inferential statistics. The results of the study revealed that students taught heat energy using enriched demonstration teaching strategy performed better than those taught the same concept using lecture method. Findings from the study further showed that both male and female students who were exposed to enriched demonstration strategy had higher performance, showing that enriched demonstration strategy is gender friendly teaching strategy. Based on the findings, it was recommended among others that Physics teachers should integrate enriched demonstration teaching strategy into their instructional practices to enhance students' engagement and understanding.

Keywords: Enriched demonstration strategy, Gender, Heat energy and Academic performance

Introduction

Physics is the branch of science that deals with the study of matter, energy, motion and the fundamental forces of nature. It is a natural science that also studies matter, its fundamental constituents, its motion and behaviour through space and time, and the related entities of energy and force. Physics is one of the most fundamental scientific disciplines, and its main goal is to understand how the universe behaves (Serway & Jewett, 2019). Physics is one of the oldest academic disciplines and through its inclusion of astronomy, perhaps the oldest. In the early 17^{th} century, Physics, Chemistry, Biology, and certain branches of mathematics are part of natural philosophy. However, during the Scientific Revolution in the 19th century these natural sciences emerged as unique research endeavours. Physics intersects with many interdisciplinary areas of research, such as Biophysics and Quantum Chemistry, and the boundaries of physics are not rigidly defined. New ideas in Physics often explain the fundamental mechanisms studied in other sciences and suggest new avenues of research in academic disciplines such as mathematics and philosophy (Esiobu, 2020). The subject matter of Physics is the physical universe, and the primary reason for studying physics is to gain a unifying understanding of the world around us. This is accomplished through the interplay of experiment and theory that constitutes the scientific method. Beyond the purely intellectual pursuit of knowledge for its own sake, there is the vast use of discovered laws of nature for the purpose of improving our material well-being.

Physics is the most basic of the physical sciences. From Chemistry, Geology, Biology and Cosmology, science is understood in terms of the concepts developed in Physics. Not only this, but many of the tools on which the advances of science and technology depend are direct product of Physics. The interests and concerns of physicists have always formed the basis of future technology. In medicine, X-rays, radioisotope and nuclear magnetic resonance imaging are used. In addition, laser, electron microscopes, synchrotron radiation, and electronics all depend on advances made in physics. The knowledge of Physics enhances electronics that modern computers rely on such as quantum mechanics. The world is much more connected than in previous historical times through the knowledge of physics as a subject. Communication is made easily and quickly likewise to running businesses around the world effortlessly with the aid of physics. In fact, almost no place on earth has been excluded from the modern interconnected world. Heat energy is one or that main branches of Physics that is in senior secondary Physics curriculum. It is a form of energy that is transferred from one body to another due to temperature difference (Seway & Jewett, 2019). Heat energy has numerous applications in various fields including engineering, Physics and everyday life. However, despite this commendable importance of teaching Physics in senior secondary schools in Nigeria, it is however worrisome to note that studies and findings had pointed out that there is low performance of students in secondary school Physics in relation to heat energy. (Onuwuakpa & Nweke, 2020). There has been clamoring each year when WAEC or NECO releases its annual results of the students' performance especially in the science subjects (Salami et. al, 2012). Students'

ISSN 2736-0091
E-ISSN 2737-0107

performance at the senior school certificate examination (SSCE) conducted by WAEC and NECO has consistently remained poor with physics having one of the worst and poorest results over the years. Over the years, examination bodies specifically test development division, West African Examination Council (WAEC) Lagos, Nigeria reported the poor performance of students in physics. For example, from 2018 to 2021 West Africa Senior Secondary Certificate Examination (WASSCE), 195,243 (representing 31.26%), 339,065 (representing 53.22%), 249,469 (representing 32.24%), and 266,819 (representing 40.60%) failed physics. The evidence of the performance of senior secondary students in Physics such as the ones illustrated above shows the level of performance in physics in secondary schools which could be caused by the method adopted in teaching.

Poor performance of students in Physics has several consequential effects, both on the individual and society as a whole. Poor performance on individual may result in students failing to grasp fundamental scientific concepts, which can hinder their academic progress in related fields such as engineering, technology, and even other sciences. Physics knowledge is essential for many high-paying and prestigious careers, including engineering, medicine, and research. Poor performance in physics could limit students' career options and earning potential in the future. Physics is the foundation of many technological advancements and scientific breakthroughs. Allowing poor performance in Physics among students could hinder innovation and slow down progress in fields such as renewable energy, healthcare, and space exploration. On economic, a workforce with a weak understanding of Physics may struggle to compete in a global economy that increasingly relies on technological innovation. This could ultimately impact the economic prosperity of a nation. In terms of scientific literacy, understanding basic physics concepts is crucial for being scientifically literate and making informed decisions about issues such as climate change, energy policy, and healthcare. Allowing poor performance in physics could contribute to a lack of scientific literacy in society (Fasanya et al., 2025). Enriched demonstration teaching strategy is an instructional strategy where teachers use demonstrations to communicate ideas, concepts, or processes to students, often incorporating visual supports like charts, posters or PowerPoint presentations. This strategy involves exhibiting objects, events, rules and sequences to help students understand complex concepts (Pangaribuan et al., 2022). Demonstration strategy involves showing by reason or proof, explaining or making clear by use of examples or experiments. In teaching through demonstration, students are set up to potentially conceptualize class material more effectively as shown in a study which specifically focuses on chemistry demonstrations presented by teachers. Demonstrations often occur when students have a hard time connecting theories to actual practice or when students are unable to understand application of theories.

Teachers not only demonstrate specific learning concepts within the classroom, they can also participate in demonstration classrooms to help improve their own teaching methods, which may or may not be demonstrative in nature. Although the literature is limited, studies show that the effects of demonstration classroom teachers include a change of perspective in relating to students, more reflection in the teachers' own classroom strategies, and more personal responsibility for student learning. Bruce et.al (2016). As pointed out by Saad and Zainudin (2022), enriched demonstration strategy is highly effective because it involves active participation of the students; it captures the students' interest reference to the intended learning outcomes and some explanatory questions to establish their current knowledge and understanding. Demonstration teaching method consists of teachers' awareness and understanding of the issues surrounding the method, such as; knowledge of questioning, identification of events that are suited to demonstration method. Others are how to demonstrate curiosity and independent thoughts in students, Hsia and Huwang (2020); they also include ability to elicit students' questions. Demonstration method can also be used to introduce a certain topic for study by presenting some vivid illustrations; it can also be used either as the starting point for a unit of instruction or to provide convincing conclusion. The relationship between demonstration method and academic performance of students in Physics has always been fascinated. It is likely true that successful learning depends on various factors other than that of the teacher. The methods that a teacher uses continue to play an important role in students' learning and in their academic performance. The challenges that educators face in the 21st century is so diverse that using better teaching methods is more crucial now than ever before (Garrison & Vaughan, 2018).

Quite remarkably, the persistent poor academic performance by the majority of students in Physics is fundamentally linked to application of ineffective teaching methods by teachers to impact knowledge to learners (Adunola, 2018). Substantial research on the effectiveness of teaching methods indicates that the quality of teaching is often reflected by the performances of learners. According to Ayeni (2021), teaching is a process that involves bringing about desirable changes in learners so as to achieve specific outcomes. In order for the method used for teaching to be effective, Adunola (2018) maintains that teachers need to be conversant with numerous teaching strategies that take recognition of the magnitude of complexity of the concepts to be covered in the classroom. The methods of teaching can be broadly classified into teacher centered and student centered. In Teacher-Centered method of teaching, teachers are the main authority figure in this model. Students are viewed as "empty vessels" whose primary role is to passively receive information (via lectures and direct instruction) with an end goal of testing and assessment. It is the primary role of teachers to pass knowledge and information onto their students. In this model, teaching and assessment are viewed as two separate entities. Student learning is measured through objectively scored tests and assessments (Petrina, 2017). In Student-Centered Approach to Learning, while teachers are the authority figure in this model,

ISSN 2736-0091
E-ISSN 2737-0107

teachers and students play an equal active role in the learning process. The teacher's primary role is to coach and facilitate student learning and overall comprehension of material. Student learning is measured through both formal and informal forms of assessment, including groups projects, student portfolios, and class participation. Teaching and assessments are connected; student learning is continuously measured during teacher instruction. Commonly used teaching methods may include class participation, demonstration, recitation, memorization, or combinations of these. Several studies such as Clarke (2021), Oyedeji (2020), Okoro (2020) among others revealed the effectiveness of demonstration method in enhancing students' performance in Physics.

Gender difference has remained a very strong issue in education since it has been linked to Performance. The existence of differences in Performance between males and females have been attributed to unequal exposure of male and female students to experiences relevant to physics learning and this is occasioned by traditional cultural attitude towards the females which restricts them from activities (Nbina & Viko, 2017). Nzewi (2020) indicates that females prefer teaching strategies that encourages students' participation in designing experiments, making inference, proposing and testing hypotheses but these are often encountered in biology than in physics and physics. Therefore, while understating the need to address gender differences represents a vital step, making education gender responsive will require a genuine commitment to provide teaching-learning experiences that reflect male and female differences. In physics learning, females tend to shy away from it because they perceive it as being difficult and they are not fully ready to carry out experiments. In this study gender was used as moderating variable. The incidence of ineffective teaching of Physics in senior secondary school has resulted to poor performance in both internal and external examinations. Most teacher while teaching do not involve the learners, learners merely absorb what is given to them, this makes them passive and less receptive, it does not encourage investigation and verification of facts, students' knowledge is limited to what their teacher teach them. Teachers must stimulate, encourage and maintain active participation of students through the selection of appropriate teaching method. Therefore, demonstration teaching method is to be adopted according to the needs of the students so that proper guidance can be given. On the basis of that, this study intends to examine the effectiveness of demonstration teaching method on academic performance of Senior Secondary School Students in heat energy in Dekina Local Government Area, Kogi State, with specific focus on how demonstration method would bring about excellent academic performance of students.

Research Questions

1. What are the pre-test and posttest performance mean scores of students exposed to experimental and control groups?
2. What is the difference between performance mean scores of male and female students exposed to experimental and control groups?

Hypotheses

The following research hypotheses were formulated to guide this study

H_{01}: There is no significant difference between the posttest academic performance mean scores of students exposed to experimental and control groups.

H_{02}: There is no significant difference between the performance mean scores of male and female exposed to experimental groups.

Methodology

The study adopted quasi-experimental design to examine the effectiveness of demonstration teaching method on academic performance of senior secondary students in Physics in Dekina Local Government Area, Kogi State. Two research questions and two hypotheses guided the study. The population for this study comprised all the 27 public senior secondary schools in the study area with 1150 Senior Secondary two (SS2) students offering Physics. The sample size for the study was 100 students from three intact classes. The three public schools were purposively selected and the number of students offering Physics in each of the schools were used as intact classes. The instrument used for data collection was Physics Performance Test (PPT), which was validated by experts. A pilot study was carried out on 30 SS2 students from one of the public secondary schools who was not part of the sampled schools but has the same characteristics. The data collected from the pilot study was analyzed using Kuder Richardson (KR-20) method for establishing the reliability coefficient of the instrument. Reliability Coefficient of 0.81 was obtained. The research questions generated were answered using descriptive statistics (mean and standard deviation), while the hypotheses were tested at 0.05 level of significance using t-test of independent.

ISSN 2736-0091
E-ISSN 2737-0107

Results

Research Question 1: What are the pre-test and posttest performance mean scores of students exposed to Enriched demonstration strategy and lecture method?

Table 1: Pretest and Posttest Analysis of Students Exposed to Enriched Demonstration and Lecture Method

		Pretest		Posttest		
Variable	**N**	**Mean**	**St.D**	**Mean**	**St.D**	**Mean gain**
Experimental	66	9.80	3.05	11.40	2.04	1.60
Control	34	5.01	3.34	6.40	3.14	1.39

From Table 1, 9.80 and 5.01 mean scores with standard deviation of 3.05 and 3.34 were recorded in the pretest for experimental and control groups respectively. At posttest, mean scores of 11.40 and 6.40 with standard deviation of 2.04 and 3.14 were recoded for experimental and control groups. The results showed that students taught heat energy using enriched demonstration strategy performed better than their counterparts taught the same concept using lecture method.

Research Question 2: What is the difference between the academic performance mean scores of male and female students taught heat energy using enriched demonstration method?

Table 2: Mean and Standard Deviation of Male and Female Students in Experimental Group

			Pretest		Posttest		
Variable	**Gender**	**N**	**Mean**	**St.D**	**Mean**	**St.D**	**Mean gain**
Experimental	Male	40	2.50	1.70	8.56	2.18	6.06
	Female	26	2.67	2.05	9.01	2.11	6.34

Table 2 revealed the mean scores and standard deviation for both pretest and posttest of male and female in the experimental group. In the pretest, the mean scores of 2.50 and 2.67 with standard deviation of 1.70 and 2.05 were recorded for both male and female. The Table further showed that in the posttest, the mean scores of 8.56 and 9.01 with deviation of 2.18 and 2.11 were also recorded for male and female. This indicated that the performance of female was slightly higher than that of the male. The implication of this is that enriched demonstration strategy is not gender biased.

Testing of Hypotheses

H_{01}: There is no significant difference between the posttest academic performance mean scores of students exposed to enriched demonstration strategy and lecture method

Table 3: t-test Analysis of Posttest Analysis of Students in Experimental and Control Groups

Variable	**N**	**Mean**	**St.D**	**Df**	**t_{cal}**	**t_{crit}**	**Decision**
Experimental	66	11.40	2.04	98	9.86	1.96	Rejected
Control	34	6.40	3.14				

From Table 3, the analysis revealed that at 0.05 level of significance, the calculated t-value (9.86) is significantly higher than the critical value (1.96). Therefore, the null hypothesis was rejected. This indicates that there was a statistically significant difference between the posttest academic performance mean scores of students taught heat energy using enriched demonstration lecture strategy and those taught the same concept using lecture method.

Decision Rule: Accept the alternative hypothesis if the t-value is greater than the level of significance, reject the null hypothesis if otherwise.

H_{02}: There is no significant difference between the posttest academic performance mean scores of male and female students exposed to enrich demonstration strategy.

Table 4: t-test Analysis of Posttest of Male and Female Students in Experimental Group

Variable	**Gender**	**N**	**Mean**	**St.D**	**Df**	**t.cal**	**t.crit**	**Decision**
Experimental	Male	40	8.56	2.18	98	0.95	1.96	Accepted
	Female	26	9.01	2.11				

ISSN 2736-0091
E-ISSN 2737-0107

The analysis in Table 4 indicated that the t-critical of 1.96 is greater than t-calculate of 0.95 at df = 98. Therefore the hypothesis was accepted. This implies that there was no statistical significance difference between the academic performance mean scores of male and female students taught heat energy using enrich demonstration strategy.

Discussion of Findings

The findings of the study on the pre-test and posttest performance mean scores of students exposed to enrich demonstration and lecture method revealed that there was statistically significant difference between the posttest academic performance mean scores of students in the two groups. The findings from the study is in agreement with Jeje (2020) who found that students exposed to demonstration strategy performed better than their counterparts who were exposed to lecture method. The study further revealed that there was no statistically significant difference between the academic performance mean scores of male and female students who were exposed to enrich demonstration strategy. This finding contradicts the findings from Jumbo (2019) who showed a statistically significant difference between the academic performance of male and female students who were exposed to demonstration method. The findings of the study are not surprising because earlier reviewed studies have shown that students taught science subjects such as Physics performed higher.

Conclusion

The study showed that enriched demonstration teaching strategy is a potent tool for improving academic performance of students in Physics. by leveraging interactive and engaging demonstrations, teachers can foster a deeper understanding of complex physics concepts, promote scientific inquiry and enhance students' problem-solving skills. The findings of this study underscore the importance of innovative teaching approaches in Physics education and provide valuable insights for educators, policy makers and stakeholders seeking to improve students' outcomes in Physics.

Recommendations

Based on the findings of this study, the following recommendations were provided.

1. Physics teachers should integrate enriched demonstration teaching strategy into their instructional practices to enhance students' engagement and understanding.
2. Educational institutions should provide resources and support for Physics teachers to develop and implement effective demonstration-based instructional materials.
3. The policymakers should encourage the adoption of innovative teaching approaches such

References

Adunola, O. (2018). *The Impact of Teachers' Teaching Methods on the Academic Performance of Primary School Pupils in Ijebu-Ode Local cut Area of Ogun State*. Ego Booster Books, Ogun State, Nigeria.

Ayeni, A. J. (2021). "Teachers professional development and quality assurance in Nigerian Secondary Schools. *World Journal of Education*, 1(2), 143-149.

Bassey, H. H. (2017). Effects of demonstration teaching strategy on students' Performance in Southwestern Nigeria. *Journal of Research & Method in Education (IOSR-JRME), 4(4), 8-13.*

Bruce, C. D., John R., Tara F. & Rich M. (2016). *Lesson study and demonstration classrooms: Examining the effects of two Models of teacher professional development.* Google. CD Bruce.

Clarke, C. F. (2021). Effect of demonstration method and lecture method on students' academic performance in Physics. *Journal of Physics Education Research and Practice, 15(2), 192-206.*

Esiobu, S. F. (2020). Teachers and students' motivation effect on students‟ Performance at junior secondary school level. Abacus: *The Journal of Mathematical Association of Nigeria*, 27 (1), 35-43.

Fasanya, A. G., Abdulwaheed, O.I., Adewumi, G. S. & Arivi, S. S. (2025. Self-concept as correlates of interest and academic performance in Physics among senior secondary school students in Kogi State. *International Journal of Arts, Communication and Pedagogy, 4*(1), 46-58.

Garrison, D. R., & Vaughan, N. D. (2018). *Blended learning in higher education: Framework, Principles, and Guidelines.* John Wiley & Sons.

Hsia, L. H., & Hwang, G. J. (2020). From reflective thinking to learning engagement awareness: A reflective thinking promoting approach to improve students' dance performance, self-efficacy and task load in flipped learning. *British Journal of Educational Technology*, *51*(6), 2461-2477.

Jeje, O. S. (2020). *Influence of demonstration, peer-tutoring and lecture method provided activities on learning outcomes of secondary school students in Ekiti State, Nigeria.* Unpublished M.Ed Thesis, Ekiti State University, Nigeria.

Jumbo, M. N. (2019) Demonstration method and academic performance of students in Physics in secondary schools in Onna Local Government Area. *Teacher Education Journal, 12* (1), 14-19.

Nbina, L. S. & Viko, M. (2017). The Effects of Small Groups Cooperation Methods and Question Strategies on Problem Solving Skills, Performance, and Attitude During Problem Based Learning. *Nigerian Journal of Business Education (NIGJBED), 5 (2), 120-138*

ISSN 2736-0091
E-ISSN 2737-0107

Nzewi, U. M. (2017). It's all in the Brain of gender And Performance in Science and Technology Education. *51st Inaugural lecture of the University of Nigeria Nsukka 18 (32), 4-13*

Onuwuakpa, J. E. & Nweke, A.I (2020). WAEC examination performance: some determinants in Anambra State. *Journal of Research in Education*, 34(1), 1-11.

Oyedeji, O. H. (2020). *Does Teaching Experience Increase Teacher Effectiveness? A Review of the Research*. Aba: Learning Policy Institute

Pangaribuan, S.M., Lin, Y. K., Chand, H. J., Widiastuti, S. H. & Yenny, Y. (2022). The implementation of demonstration method to increase learning outcome in natural science lessons. *Jurnal Pendidkan Anak Usia Dini*, *6*(4), 3680-3692. DOI:10.31004/obsesi.v6i4.1711.

Petrina, S. (2017) *Advance Teaching Methods for the Technology Classroom* (pp.125-153). Hershey, PA: Information Science Publishing.

Saad, A., & Zainudin, S. (2022). A review of Project-Based Learning (PBL) and Computational Thinking (CT) in teaching and learning. *Learning and Motivation*, *78*, 101802.

Salami, A. M., Mohammed, S & Ogunlade, Y. A. (2012). WAEC and NECO as predictors of university performance. *International Journal of Educational Administration and Policy Studies*, *4*(7), 80-88.

Serway, R. A., & Jewett, J. W. (2019). *Physics for scientists and engineers with modern Physics.* Cengage Learning.