Faculty of Natural and Applied Sciences Journal of Mathematics and Science Education
Print ISSN: 2814-0885 e-ISSN: 2814-0931
www.fnasjournals.com
Volume 5; Issue 2; March 2024; Page No. 57-62.

Effect of Activity-Based Method on Students' Academic Performance in Basic Science

Green, B.
Department of Integrated Science, Ignatius Ajuru University of Education, Port Harcourt, Nigeria

Corresponding author email*:* balafama.green@yahoo.com

Abstract
The study investigated the effect of the activity-based method on the academic performance of students in Basic Science. Using a quasi-experimental design with a pre-test-post-test control group setup, the study involved 87 Junior Secondary School two (JSSII) Basic Science students from two co-educational schools in Port Harcourt City Local Government Area, Rivers State, Nigeria, selected purposively. The data collection instrument was the Achievement Test in Basic Science (ATBS), which demonstrated a reliability coefficient of 0.76 through a test-re-test technique. Data analysis employed Analysis of Covariance (ANCOVA). The results revealed a significant difference in the academic achievement of students exposed to activity-based methods compared to those taught using expository techniques. Notably, students in the activity-based method group outperformed their counterparts in the expository technique group. Additionally, gender did not exert a significant influence on students' academic achievement in Basic Science. Based on these findings, recommendations include advocating for the government's provision of well-equipped and functional laboratories conducive to implementing activity-based methods, thereby enhancing students' academic performance in basic science.

Keywords: Effect, Activity Based, Expository Technique, Academic Performance

Introduction

Science plays a pivotal role in driving the progress of nations, serving as the fundamental pillar of technological advancement. As described by Ogunleye (2002), science represents a dynamic human endeavour aimed at understanding the intricacies of the modern world. Countries worldwide are striving to bolster their technological capabilities, a goal achievable only through a robust foundation in science and technology education. Establishing such a foundation entails fostering students' interest in science, particularly Basic Science, starting from their junior secondary school years. In Nigeria, organizations like the Science Teachers' Association of Nigeria (STAN) and the Comparative Education Study and Adaptation Centre (CESAC) have made significant contributions to curriculum innovations in science through initiatives like the Nigerian Secondary Schools Science Project (NSSSP). Many of these innovations emphasize inquiry-based programs that focus on student-centred, active learning, critical thinking, and problem-solving approaches. The history of education in Nigeria traces a lengthy and intricate trajectory and evolution. Before the introduction of Western education, traditional African education prevailed, characterized by the transmission of knowledge through oral traditions, myths, and proverbs. However, with the arrival of Western education in Nigeria, significant changes occurred in the educational landscape. The establishment of the first mission school in Badagry in 1843 by the Methodist Missionary Society marked the onset of Western education in Nigeria. Initially, these schools' curricula centred on teaching the English language and basic arithmetic. Subsequently, in the late 1800s, the British colonial government initiated the establishment of schools across Nigeria, primarily to train civil servants for administrative roles in the colonial administration. The curriculum of these schools expanded to include subjects such as English language, mathematics, and science.

Following independence, Nigeria experienced a significant expansion in its education sector, with the government taking a more proactive stance in providing education. The 1970s witnessed the introduction of universal primary education, accompanied by the establishment of new schools and universities nationwide. However, the 1980s brought about a decline in education quality in Nigeria, attributed to challenges such as insufficient funding and ineffective

Cite this article as:
Green, B. (2024). Effect of activity-based method on students' academic performance in Basic Science. *FNAS Journal of Mathematics and Science Education, 5*(2), 57-62.

management. This decline persisted into the 1990s, leading many Nigerian students to pursue educational opportunities abroad due to the deteriorating state of the country's education system. The 2000s marked a resurgence in efforts to improve Nigeria's education sector. The government-initiated programs like the Universal Basic Education (UBE) program, aim to ensure that every Nigerian child has access to quality education. Furthermore, increased funding and reforms were introduced to enhance the quality of teaching and learning. The history of science education in Nigeria dates back to 1867 when it was initially introduced as nature study and hygiene. Over time, it evolved into distinct disciplines such as biology, chemistry, and physics. In an attempt to present science in a culturally relevant manner, reflecting Nigerian traditions, the concept of the Nigeria Integrated Science Project (NISP) emerged. This project sought to teach science as an integrated whole, as advocated by the Science Teachers' Association of Nigeria in 1970. It is recommended that the teaching of Basic Science should incorporate active learning strategies, problem-solving tasks, and hands-on field or laboratory exercises. Previous research on Basic Science education has highlighted that traditional teaching methods, such as lectures and note-giving by teachers, are common in Basic Science classrooms. These traditional methods have significant implications for students' cognitive achievement in Basic Science.

Research findings have indicated that laboratory-based teaching methods, which emphasize the processes of science, can be effective in enhancing students' achievement in science. For instance, Comber and Reeves (1973) observed that students who engaged in scientific processes in their school settings demonstrated higher levels of achievement in science. Engaging in the processes of science provides students with valuable opportunities to explore abstract concepts and generalizations using tangible materials. Through interactions with learning materials, teachers, and peers, and by practising scientific methodologies, students gradually develop the essential skills required for future endeavours in science. However, the Nigerian Integrated Science Project emphasizes the learning of scientific processes rather than the mere acquisition of scientific knowledge. Consequently, one would anticipate a significant portion of Basic Science lessons to be dedicated to investigative activities. Given this emphasis, Basic Sciences hold great significance in the junior secondary school curriculum. The Nigerian government initiated Basic Science education in secondary schools for several key reasons:

1. To serve as a unifying factor for different science subjects by emphasizing the processes of science.
2. To provide students with a broad understanding of the realm of science.
3. To enable students to comprehend their environment holistically rather than in isolated segments.
4. To furnish junior secondary school students with a solid foundation for pursuing further education in science, whether in individual science disciplines or through continued Basic Science studies.
5. To promote scientific literacy among the populace.

Learners need to understand these processes through an integrated approach to learning science (Federal Ministry of Education, 2004). Numerous research studies have been conducted to enhance the quality of science education. Within the realm of Basic Science education, studies have indicated that many junior secondary school students develop negative attitudes toward the subject. As a result of their poor performance in Basic Science, many students at this level do not fully benefit from the curriculum (Afuwape, 2003). Afuwape and Olatoye (2004) argue that this situation often deters students from pursuing core science subjects or achieving success in these subjects at the senior secondary school level. Despite the Nigerian government's initiatives to stimulate interest in science and science-oriented programs, such as the 60:40 admission ratio favouring science-oriented programs, the desired outcomes have not been fully realized. Many junior secondary school students do not exhibit interest in studying core science subjects (Physics, Chemistry, and Biology) at the senior secondary school level, consequently affecting their choices of science-oriented programs at the tertiary level. This issue has been attributed to the ineffective and unproductive strategies employed by Basic Science teachers at the junior secondary school level. Numerous studies have been conducted to promote effective teaching strategies for Basic Science, including the activity-based approach. The Basic Science curriculum is designed to be child-centred, placing greater emphasis on learning science as a process rather than simply acquiring knowledge. Consequently, teachers are encouraged to actively engage students in the teaching and learning of Basic Science. The activity-based approach was specifically selected because it facilitates greater student involvement in the learning process compared to traditional methods, aligning with the principles of the Basic Science curriculum.

In an activity-based approach, teachers typically structure learning activities to encourage students to work collaboratively in groups. This collaborative learning environment fosters the development of scientific classroom communities, where students collaborate to discuss and experiment with solutions to scientific problems. Through

Cite this article as:
Green, B. (2024). Effect of activity-based method on students' academic performance in Basic Science. *FNAS Journal of Mathematics and Science Education, 5*(2), 57-62.

cooperative learning, students are empowered to formulate questions, exchange ideas, clarify concepts, experiment, brainstorm, and present solutions alongside their peers. This approach enables students to gain exposure to multiple perspectives and solutions to scientific challenges. However, research findings indicate that the teaching of science in Nigerian secondary schools often falls short of expected standards. Current teaching methods employed in secondary schools are deemed inadequate for fostering the acquisition of science process skills among students. These methods typically include demonstrations, drills, lectures, direct observations, field trips, group work, laboratory activities, reading assignments, recitations, seminars, and programmed instruction. Effective science teaching should prioritize laboratory-centered, activity-oriented approaches over textbook or lecture-centered methods, which are prevalent in Nigerian schools. It is within this context that the impact of activity-based methods and expository techniques on students' academic performance in junior secondary school Basic Science is explored.

Statement of the Problem

There is growing concern over the persistent decline in the standard of science education at the secondary school level in Nigeria. Despite substantial government investments aimed at improving science teaching and learning, the performance of students in public examinations remains unsatisfactory. The continuous poor performance in science subjects at the School Certificate level has led to the assumption that many science teachers in Nigerian secondary schools may not be utilizing diverse teaching strategies effectively to address specific challenges associated with science education. Against this backdrop, this study investigated the impact of activity-based methods and expository techniques on students' academic performance in junior secondary school Basic Science.

Aim and Objectives of the Study

The purpose of this study was to investigate the effect of activity-based methods and expository techniques on students' academic performance in basic science. Precisely, the study ought to:

1. Determine the effect of activity-based method and expository technique on students' academic performance in Basic Science
2. Determine the influence of gender on students' academic performance when taught using an activity-based method.

Hypotheses

Two null hypotheses tested in the study were:

H_{01}: There is no significant difference in the academic performance of students exposed to activity-based methods and those taught using expository technique

H_{02}: There is no significant difference in the academic performance of male and female students exposed to instructional methods.

Methodology

This design was selected to assess participants' initial behaviours before and after the intervention during the study. A quasi-experimental design was chosen because intact classes were utilized by the researcher. The population for this research comprised all junior secondary school two (JSS II) basic science students in Port Harcourt City Local Government Area of Rivers State. Two out of the twenty-two junior secondary schools in Port Harcourt Local Government Area of Rivers State were selected for the study through purposive sampling. The selection criteria for the schools were as follows:

- Government approval of the schools.
- Availability of a functional Basic Science laboratory meeting standard requirements.
- The schools should have been operational for a minimum of ten years.
- The sample size for the study consisted of 87 subjects, comprising 40 male and 47 female students.

The data collection instrument utilized was the Achievement Test in Basic Science (ATBS), designed to assess students' performance in Basic Science. It comprised a 20-item multiple-choice questionnaire covering the curriculum content of junior secondary school two (JSS II) Basic Science. The topics covered by the instrument included water pollution, physical and chemical changes, work, energy, and power. The ATBS was administered as both a pre-test and a post-test. The instrument was face and content validated by the two secondary school Basic Science teachers and two experts in science education. The experts were required to look at the

Cite this article as:
Green, B. (2024). Effect of activity-based method on students' academic performance in Basic Science. *FNAS Journal of Mathematics and Science Education, 5*(2), 57-62.

appropriateness of the items in the instrument in measuring the expected knowledge and on the correctness of the questions. Based on their comments, the instruments were restructured and hence refined to meet the face and content validity requirements. To ensure the reliability of the instrument, a test-retest technique was employed. A trial test was carried out by administering the ATBS instrument at an interval of two weeks on thirty (30) non-participating junior secondary school two (JSS II) students from one of the schools outside the Local Government Area used for the study. A reliability coefficient of 0.76 was obtained which was considered appropriate for the study.

Data collection occurred in three phases: the pre-test lasted for one week, followed by six weeks of treatment, and concluded with the post-test administered during the final week. Each week during the treatment phase, three periods of 40 minutes were dedicated to the study. The scheduling adhered to the school's Basic Science timetable without any alterations. During the lessons, the teacher introduced new topics, sub-topics, concepts, and related ideas. In the activity-based group, practical activities followed immediately after the theoretical lessons, allowing students to apply the knowledge they had just acquired. Conversely, the control group received instruction using the conventional expository method. The Achievement Test in Basic Science (ATBS) was scored out of 100%. Data collected from administering the instrument underwent analysis using Analysis of Covariance (ANCOVA). All hypotheses were tested at a significance level of $p < 0.05$.

Hypotheses

H_{01}: There is no significant difference in the achievement of Basic Science students exposed to activity-based methods and expository techniques.

H_{02}: There is no significant in the achievement of male and female Basic Science students exposed to activity-based methods.

Table 1: One-way Analysis of Covariance (ANCOVA) of post-test scores of Basic Science students.

Source	SS	Df	MS	F	p
Corrected Model	7794.299[a]	4	1948.575	69.448	.000
Intercept	1368.161	1	1368.161	48.762	.000
Group	948.390	1	948.390	33.801	.000
Gender	38.937	1	38.937	1.388	.242
PreTest	6239.301	1	6239.301	222.371	.000
Group * Gender	20.042	1	20.042	.714	.400
Error	2300.758	82	28.058		
Total	243993.000	87			
Corrected Total	10095.057	86			

a. R Squared = .772 (Adjusted R Squared = .761)

Table 1 displays the analysis of the significant main effect of the activity-based method on student performance. As indicated in Table 1, the F-value obtained is 33.801, with a corresponding p-value of 0.000. Given that the p-value is below 0.05, it indicates that incorporating practical activities into Basic Science instruction significantly impacts student achievement. Additionally, the table presents a multiple regression squared index (R^2) of .772, suggesting that 77.2% of the total variance in Basic Science student achievement can be attributed to the influence of instructional approaches. The results reveal that the F-value acquired in the analysis is 1.388 at p=0.242. Since the p-value exceeds 0.05, it can be inferred that there exists no significant disparity in the performance of male and female Basic Science students when exposed to different instructional methods.

Discussion

The results of this study indicate a notable difference in the performance of students exposed to activity-based methods compared to those taught using expository techniques. Specifically, learners in the activity-based method group outperformed their counterparts in the expository technique group, suggesting that the experimental group achieved higher scores than the control group. Consequently, the null hypothesis is rejected. This outcome aligns with the research findings of Turpin and Cage (2004), who observed positive effects of activity-based methods on student academic performance. The observed improvement in performance may be attributed to the active engagement of

students in the teaching and learning process. Additionally, this finding is consistent with the conclusions drawn by Anderson (2002), who asserted that the implementation of inquiry-based science teaching leads to favourable outcomes in cognitive achievement. Other scholars such as Hofstein and Lunetta (2004), Bilgin (2006), Ergul et al. (2011), and Ndirika (2012) have also supported the outcomes of this study through their respective research findings. Moreover, the study revealed that gender did not exert a significant influence on the performance of subjects in Basic Science. This indicates that male and female students exposed to activity-based methods exhibit similar academic performance levels. This equality in performance could be attributed to the equitable opportunities provided for both genders to actively participate in the teaching and learning process. Consequently, it can be inferred that activity-based methods are inclusive and do not favour one gender over the other. This finding resonates with the research conducted by Arigbabu and Mji (2004), and Bilesanmi-Awoderu (2006), who found no discernible differences in the cognitive, affective, and psychomotor skill achievements of students based on gender. However, this conclusion contradicts the findings of Usman (2000) and Aigboman (2002), who reported that boys outperformed girls significantly in science-related subjects.

Conclusion

The findings of this study indicate that students who were exposed to the activity-based method performed superiorly compared to those taught using the expository technique. The method was also found to favour both genders equally. Given that Basic Science is inherently practical-oriented, employing this approach can enhance both teaching and learning outcomes. By engaging in laboratory activities, students can develop a deeper understanding of scientific principles by interacting with tangible objects, thus moving beyond theoretical abstractions.

Recommendations

The following recommendations were made which include;

1. School management should also assist teachers who wish to improvise instructional materials by way of supplementing the cost, if not sponsoring it.
2. The authors of science method books should illustrate carefully in their books how to make use of an activity-based approach to science teachers.
3. The government should also ensure the provision of good functional laboratories that can serve as venues for further teaching and learning of science concepts, from which an activity-based approach can be utilized to improve students' academic achievement in Basic Science.
4. The in-service level, seminars and workshops should be organized by the ministry, officials, zonal educational authority, and local educational authority to educate practising teachers on how to implement an activity-based approach in the teaching and learning of Basic Science.
5. Science teachers should learn and use activity-based instructional strategies as a means of improving students' achievement in mixed-gender and ability classes.

References

Afuwape, M. O. (2003). Teacher and school factors as predictors of student's achievement in integrated science. *African Journal of Educational Research,* 9(1&2), 89 – 96.

Afuwape, M. O., & Olatoye, R. A. (2004). Students integrated science achievement as a predictor of later achievement in Biology, Chemistry and Physics. *Journal of Science Teachers' Association of Nigeria,* 39(12), 11- 16.

Aigboman, D.O. (2002). *Science for the teacher and national development*. Benin City: Anibik Press.

Anderson, R. D. (2002). Reforming science teaching: What research says about inquiry. *Journal of Science Teacher Education,* 13, 1-12.

Arigbabu, A. A., & Mji, A. N. D. I. L. E. (2004). Brief Report: Is Gender a Factor in Mathematics Performance Among Nigerian Preservice Teachers?. *Sex Roles*, *51*, 749-753.

Bilesanmi-Awoderu, J. B. (2006). Effect of computer-assisted instruction and simulation/games on the academic achievement of secondary school students' in Biology. *Sokoto Educational Review*,8(1), 49 – 60.

Bilgin, I. (2006). The effects of hands-on activities incorporating a cooperative learning approach on eighth-grade students' science process skills and attitudes toward science. *J. Baltic Science Education, 1*(9), 27-37.

Comber, L. C.,& Reeves, J. P. (1973). Science Education in Nineteen Countries, Stockholm: Almqvist and Wiksell and New York: Wiley Halsted Press,-1973.

Cite this article as:
Green, B. (2024). Effect of activity-based method on students' academic performance in Basic Science. *FNAS Journal of Mathematics and Science Education, 5*(2), 57-62.

Ergul, R., Simsekli, Y., Calis, S., Ozdilek, Z., Gocmencelebi, S. & Sanli, M. (2011). The effects of inquiry-based science teaching on elementary school students' science process skills and science attitudes. *Bulgaria Journal of Science and Education Policy (BJSEP),* (1), 48-68

Federal Ministry of Education (2004). National Policy on Education. Lagos: NERDC.

Hofstein, A. & Lunetta, V. N. (2004). The laboratory in science education: Foundation for the 21st century. *Science Education, 88*, 28-54.

Ndirika, M. C. (2012). Achievement variations of Basic Science students taught with teacher -centered, teacher/student-centered and student-centered instructions in Kaduna State, Nigeria. *Journal of Educational and Social Research.* 2(8), 24-33.

Ogunleye, B. O. (2002).Towards the optimal utilisation and management of resources for the effective teaching and learning of Physics in schools. *Proceedings of the 41st Annual Conference of the Science Teachers' Association of Nigeria.* University of Lagos, Nigeria PP.215-220

Turpin, T. & Cage, B. N. (2004). The effects of an integrated, activity –based science curriculum on student achievement, science process skills and science attitudes. *Electronic Journal of Literacy through Science,* 3,

Usman, I. A. (2000). *The relationship between students' performance in practical activities and academic achievement in integrated science using NISTEP mode of teaching.* Unpublished PhD Thesis, Faculty of Education, Ahmadu Bello University, Zaria.