Faculty of Natural and Applied Sciences Journal of Mathematical and Statistical Computing
Print ISSN: 3026-8605, e-ISSN 3043-632X
www.fnasjournals.com
Volume 2; Issue 1; September 2024; Page No. 53-57.

Effect of Periodic Assessment on Basic Science Achievement among Junior Secondary School Students

Oshodi, O. O.
Department of Guidance and Counselling, Lagos State University of Education, Nigeria

Corresponding author email: oshodioo@lasued.edu.ng

Abstract
This study investigated the effect of periodic assessment on students' achievement in basic science at the Junior School level. Periodic assessment refers to the regular and systematic evaluation of students to ensure they are conversant with whatever content of knowledge that they are imparted. This can be done on a weekly, monthly, quarterly or annual basis. Periodic testing is crucial in the field of education to evaluate students' understanding and progress, to identify areas of weakness of students, to enhance knowledge retention of information and to prepare students for the next academic task which can be competitive in nature. A pretest-posttest, non-randomized control group design was employed to collect data from 81 junior secondary school class three (JSS III) students in two schools in Nigeria. The experimental group received periodic tests, while the control group did not. Results showed that students exposed to periodic testing during instructions performed significantly better than the students in the control group (who received no periodic testing) during instruction. These findings support the notion that regular assessment is crucial for enhancing learning outcomes in this subject. The study recommends increased implementation of periodic testing in schools and further research to explore its long-term effects.

Keywords: Basic Science, Instruction, Periodic Assessment, Students' Achievement

Introduction

With science dominating the global economy, one could argue that the survival of a nation is directly or indirectly dependent on science and technology. As a result, many countries have integrated science education into their curricula to expose students to it at an early age. Nigeria is no exception, as it plays a crucial role in fostering scientific literacy and critical thinking among students by exposing them to the fundamental concepts and processes of science as observed by Oludipe and Idowu (2011, p. 134). In other words, science is linked to critical thinking, and the infusion of science subjects is a conscious effort made by governments for the nation to get to a certain level of the global scientific status quo and to serve as a foundation that prepares them for future specialization in science-based courses and help them understand the role of science in everyday life. One of the science courses incorporated into the Nigerian educational curriculum is integrated science, which is now referred to as basic science.

Basic science is a mandatory school subject for all Nigerian students, especially at the junior secondary school level. Since basic science concepts are organized into themes in the different science disciplines according to Chima (2021, p.101), students are invariably subject to developing reflective thinking and skills like attention to detail, observing, manipulating, classifying, and problem-solving, which are needed for scientific engagements. According to Agogo and Ode (2011) in Chima (2021), the skills previously mentioned are not only needed for scientific methods but for a successful future life. The affirmation by Agogo and Ode (2011) could be said to mean that one of the long-term goals of the Nigerian education system for incorporating basic science into the nation's curriculum is to produce notable successful science figures.

Ikechukwu (2015, p.80) stated that the introduced 6-3-3-4 education system in Nigeria by Babatunde Fafunwa is aimed at not only training students to be self-reliant and successful but also to separate students based on their abilities, i.e., technical abilities and academic abilities. However, students' abilities cannot be identified without measuring their achievements periodically, and this can be done by subjecting them to assessment. This is why a

prominent feature of Nigeria's 6-3-3-4 (now 9-3-4) educational system policy is the continuous assessment of students' progress and performance (FRN, 1981).

Periodic achievement refers to the regular assessment of students' understanding and performance in a particular subject or topic. It is different from summative assessment as stated by Umar (2018:16) because it is obtained from the periodic formative assessment of students at predetermined intervals of the school year. It is worth noting that these assessments may be in the form of observation of students' behaviour, tests, quizzes, projects, practical exercises, written assignments, presentations, etc., as the teacher deems fit. Denga (1984) opined that among the major reasons for the adoption of continuous assessment in the Nigerian school system is the need to effectively monitor, guide, and improve the performance of the students and that of the overall educational system. So, periodic achievement assessments in basic science serve as tools for evaluating students' progress and identifying areas for improvement in the subject's learning process, just as affirmed by the authors of the NCTM (1995) in Shepard (2001, p. 63) that assessments offer a conception of classroom assessment that depends on the close intertwining of student growth and instructional improvement purposes.

Several research has been carried out to highlight the importance of periodic achievement assessment. For example, Oyinloye and Imenda (2019) conducted a quasi-experimental study in South Africa that showed that students exposed to periodic assessments significantly improved in their academic performance because it facilitated personalized learning, allowing teachers to tailor their methods based on individual student needs and progress. Equally, a study by De Vries et al. (2022) shows that when periodic assessment is effectively integrated to measure students' periodic achievement, it can lead to substantial gains in students' achievement. In the same manner, Hattie and Timperley (2007) emphasized that effective assessment practices, including teacher-led feedback and student engagement in self-assessment, have been shown to positively influence student achievement across various educational contexts.

Despite the importance of basic science and the benefits of periodic achievement assessments on students' learning outcomes in basic science in Nigeria, scholars like Adedayo (1994) concluded that periodic testing had no effect, further stating that it is inconclusive. Based on this, the effect of periodic/systematic assessment which cannot be downplayed nor regarded as non-consequential has to be looked into. It is therefore important to investigate his assertion.

Assessment strategies, theories, and students' achievement

Many studies have been carried out on how educational theories support the relationship between periodic assessment strategies and student achievement. Some of these theories are formative assessment theory, feedback mechanisms, and constructive learning theory.

Formative Assessment Theory emphasizes the importance of timely and constructive feedback. Shedding light on this, Oyinloye and Imenda (2019) argued that time-to-time assessments should be integrated into the learning process because they are crucial for fostering self-regulated learning and motivating students to take ownership of their learning journey. One could state that this implies that this theory believes that when ongoing feedback is provided to students, it helps them identify their strengths and areas for improvement in subjects like basic science.

Feedback mechanisms are described by Sadler (1989) in Umar (2018:17) as a decisive element in the assessment for learning because he considers feedback as an attempt to give information to close the gap between the student's current learning status and their desired learning goals. Elaborating more on this, Sadler (1989) in Umar (2018:17) further stated that "*information itself is not feedback, but only becomes so when it is actively used to alter the gap.*". One could argue that Sadler's assertion implies that through effective feedback which has the qualities of being specific, timely, and directly linked to learning objectives, students will not only be informed about their current performance in basic science but will also be guided on how to improve.

Self-regulated learning views self-assessment through active engagement and self-reflection as a key tool to achieving higher levels of understanding and mastery in school subjects which includes basic science. This goes in line with Umar's (2018) point of view that when students engage in self-regulation, they are more likely to achieve higher levels of understanding and mastery in school subjects. For this to take place, there is a need for students to take ownership of their learning by actively and consciously participating in self-assessment and peer-assessment activities related to basic science.

These theories show that when effective assessments are carried out periodically in basic science education, not only will students' performance increase but a deeper engagement with scientific content is being promoted. The

Cite this article as:
Oshodi, O. O. (2024). Effect of periodic assessment on basic science achievement among Junior Secondary School Students. *FNAS Journal of Mathematical and Statistical Computing*, *2*(1), 53-57.

objective of the study is to investigate the effectiveness of periodic testing on students' achievement in basic science.

Research Question

The research seeks to find the answer to the question which state that:

- What effect does periodic assessment have on learners' outcomes in Basic Science?

Methodology

The study employed a pretest-posttest, nonrandomized control group design. Pretest-posttest studies are commonly used to evaluate the effect of a treatment or an intervention, as stated by Zhang et al. (2019). However, since *it is appropriate for experimental and quasi-experimental studies* (Fraenkel & Wallen, 2003) in Aydin et al., (2016:3), it can be used as an academic research methodology. For the pretest-posttest methodology, researchers measure a dependent variable before the intervention (the pretest) and again after the intervention (the posttest). Unlike randomized pretest-posttest studies, where subjects are randomly assigned to one of the treatment groups or the control group (Zhang et al., 2019), in non-randomized studies, participants are not randomly assigned to groups. Two classes were randomly assigned to the experimental and control groups. The control group does not receive intervention, allowing for comparison against the experimental group. The sample used for the study comprised 81 Junior Secondary Class III (JSSIII) students from two secondary schools. Out of these, 44 were male students, while 37 were female students. In each school selected to take part in the study, one intact JSSIII class was randomly chosen to participate in the study. The two intact classes were then randomly assigned to the experimental and control groups. Pretests and protests were employed for data collection in this study. The tests, consisting of 30 multiple-choice items, were constructed by the researcher in line with his knowledge of test construction. The initial versions of the test were scrutinized by colleagues in educational measurement and biology education before a trial administration on a sample of 32 students at the same level who did not participate in the study. A re-administration yielded test-retest items judged to be of comprehension level and relatively few on knowledge of application level. Before the experiment, both the experimental and control groups were given a pretest on the content areas covered before the experiment. A few days later, instruction commenced. The experimental group was given periodic tests after every two weeks of instructions, while this was absent in the control group.

Results

Table1: Summary of Covariate on posttest scores

Source of variation	Ss	Df	Ms	F	P
Covariate (Pretest)	321.2	1	321.2	2.61	2.31
Treatment	155.3	1	155.3	6.341	0.42
Residual	652.51	78	24.49		
Total	1129.01	80			

Highly significant at 0.05

Table 1. Provides a comparison of students' posttest scores using pretest scores as covariates. The effect of the pretest was not significant, $F(1, 78) = 2.61$, $p<0.05$. There was however significant effect associated with treatment on the achievement of students, $F(1,78) = 6.341$, $p<0.05$. The results indicate that students in both groups were equivalent before treatment, but a significant difference was observed between the two groups after treatment. To determine the direction of the significant effect, post means and gain scores for the experimental and control groups were compared as contained in Table 2 below.

Cite this article as:
Oshodi, O. O. (2024). Effect of periodic assessment on basic science achievement among Junior Secondary School Students. *FNAS Journal of Mathematical and Statistical Computing*, *2*(1), 53-57.

Table 2: Posttest means and gains scores

Groups	Pretest mean	Posttest mean	Gain Score mean
Experimental	52.8	59.7	6.9
Control	53.1	54.9	1.8

Table 2 shows that the gain mean score of the experimental group (6.9) is greater than the gain mean score of the control group (1.8). Thus the result supports that the experimental group has performed significantly better than the control group in the basic science concepts measured in this study.

Discussion

The data provided in this study provides support for the effectiveness of periodic testing on students' achievement in basic science. The results indicate that students exposed to periodic testing at a predetermined interval of the instructional period performed significantly better than their counterparts who were not exposed to periodic testing. This result is consistent with the findings of Afenikwe (1985) in James and Folorunso (2012), who concluded that formative evaluation is very productive in improving learning outcomes in mathematics and found that students undergoing remediation attain a higher level of cognitive achievement than students undergoing instructional programs without remediation. The outcome of the study further opposes Adedayo's (1994) conclusion that periodic testing had no effect and is inconclusive because we see that the intervention, which was implemented in the experimental group, appears to be an effective strategy for enhancing student learning in basic science concepts compared to the controlled group. Equally, the low performance of the control group may be concluded to be linked to their not having opportunities to explore their problems with the teacher.

The Nigerian government should therefore provide adequate support for the effective implementation of continuous assessment in schools. Teacher training on continuous assessment operations should be intensified by the government in conjunction with teacher-training institutions and educational research and curriculum bodies. Educators may consider incorporating similar strategies into their teaching practice to improve students' achievement in this subject area. However, it is important to note that the study has some limitations due to its choice of a nonrandomized control group design, which may threaten its internal validity, because it may be said to have been prone to selection bias and variables. Additionally, the generalisability of the findings may be limited due to the specific characteristics of the participants and the context in which the study was conducted.

References

Adedayo, O.A (1994). The effect of guidance-oriented periodic testing on mathematics test anxiety and knowledge achievement of low achievers in NCE Mathematics. *Lagos Journal of Science Education*

Afemikhe, O. A. (1985). The effect of formative testing on students' achievement in secondary school mathematics. Unpublished Ph. D. Thesis, University of Ibadan, Ibadan.

Agogo, P. O., & Ode, J. O. (2011). Issues in Nigeria integrated science curriculum. Makurdi: Optimism Press Publishers.

Aydın, U. et al. (2016). Impacts of a university–school partnership on middle school students' fractional edge: A quasi-experimental study. *The Journal of Educational Research*, *111*(2), 151–162. https://doi.org/10.1080/00220671.2016.1220358

Chima, T. S. (2021). Basic science curriculum and development in Nigeria: Post covid-19 challenges and prospects. *Unizik Journal of Educational Research and Policy Studies*, *7*, 100-114. https://unijerps.org/index.php/unijerps/article/view/148

De Vries, J. A., et al. (2022). The impact of an assessment for learning teacher professional development programme on students' metacognition. *School Effectiveness and School Improvement*, *34*(1), 109-129. https://doi.org/10.1080/09243453.2022.2116461

Denga, D. I. (1986). An introduction to the foundation of education. Rapid Educational Publishers Ltd.

Federal Ministry of Education (1981). National policy on education. NERDC Press.

Fraenkel, J. R., & Wallen, N. E. (2003). Observation and interviewing. How to design and evaluate research in education, 5, 455-463.

Hattie, J., &. Timperley, H. (2007). The power of feedback. *Review of Educational Research*, *77*(1), 81–112. https://doi.org/10.3102/003465430298487

Ikechukwu, E. C. (2015). Towards a pragmatic system of education: A comparative study of Nigeria 6-3-3-4 and Chinese 9-3-4 system. *International Journal of Educational Research*, *3*(5). http://ijern.com/journal/2015/May-2015/07.pdf

James, A. O., &. Folorunso, A. M. (2012). Effect of feedback and remediation on students' achievement in junior secondary school mathematics. *International Education Studies*, *5*(5). https://doi.org/10.5539/ies.v5n5p153

Oludipe O., &. Idowu, D. (2011). Developing Nigerian integrated science curriculum. *International Journal of Science and Technology Education Research*, *2*(8), 134–145. https://doi.org/10.5897/ijster.9000008

Oyinloye, O. M., &. Imenda, S. N. (2019). The Impact of Assessment for Learning on Learner Performance in Life Science. *EURASIA Journal of Mathematics, Science and Technology Education*, *15*(11).

Sadler, D. R. (1989). Formative assessment and the design of instructional systems. Instructional Science, 18, 119-144. https://doi.org/10.1007/BF00117714

Shepard, L. (2001). The role of classroom assessment in teaching and learning. Center for the Study of Evaluation National Center for Research on Evaluation, Standards, and Student Testing Graduate School of Education and Information Studies University of California. https://jan.ucc.nau.edu/jf36/465word/shepardarticle.pdf

Umar, A. M. A. (2018). The impact of assessment for learning on students' achievement in English for Specific Purposes A case study of Pre-Medical students at Khartoum University, Sudan. *Journal of English Language Teaching*, *11*(2), 15. https://doi.org/10.5539/elt.v11n2p15

Zhang, S, et al. (2019). Empirical likelihood inference for non-randomized pretest-posttest studies with missing data. *Electronic Journal of Statistics*, *13*(1). https://doi.org/10.1214/19-ejs1566