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Effect of Mini-Anchor-Chart Strategy on Academic Performance of Dissimilar Learning Rapidity Basic-8 Students in Basic Science, Obudu, Cross River State

Geoffrey Aondolumun Ayua[1], Elizabeth Uwhekemne Adie[2], Anna Agbidye[3], Benjamin Akura Taangahar[4], Kelvin Samuel[5] & Gabriel Sesugh Ikyernum[6]

[2]Department of Integrated Science, Federal College of Education, Obudu, Cross-River State, Nigeria
[1, 3-4 & 6]Department of Science Education, Rev. Fr Moses Orshio Adasu University, Makurdi (formerly, Benue State University), Nigeria.
[5]Department of Science Education, Ahmadu Bellow University, Zaria, Kaduna State, Nigeria

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***Corresponding Author:** Geoffrey Aondolumun AYUA - ayuageoffrey@gmail.com

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Abstract **Original Research Article**

This study investigated the effect of the Mini-Anchor-Chart Strategy (MACS) on the academic performance of Basic 8 students with dissimilar learning rapidity in Basic Science in Obudu, Cross River State, Nigeria. A pre-test post-test non-randomized quasi-experimental control group design was adopted. The sample comprised 68 Basic 8 students drawn from two intact classes in government-owned upper basic schools. Students were classified into fast, moderate, and slow learners using the Students Learning Rapidity Classification Quiz. The experimental group (n=34) was taught using the Mini-Anchor-Chart Strategy, while the control group (n=34) was exposed to the conventional expository teaching strategy. The Basic Science Performance Test (BSPT), a 25-item multiple-choice instrument with a reliability coefficient of 0.848, served as the data collection tool. Results from Analysis of Covariance (ANCOVA) revealed a statistically significant difference in academic performance between the two groups, $F(1,65) = 257.754$, $p < 0.05$, with the MACS group recording a higher mean gain score (7.41) compared to the expository group (2.14). However, within the MACS group, no significant difference was found in the academic performance of students across the three levels of learning rapidity, $F(2,30) = 0.321$, $p > 0.05$. The findings indicate that the Mini-Anchor-Chart Strategy is an effective learner-centred instructional approach that substantially enhances academic performance in Basic Science irrespective of students' learning speed. It is recommended that Basic Science teachers adopt this strategy to improve learning outcomes in Nigerian basic education.

Keywords: Mini-Anchor-Chart Strategy, Academic Performance, Learning Rapidity, Basic Science.

Introduction

No one can underestimate the importance of both science and technology in the life of a country. The rationale behind this is that science education is important in the empowerment of citizens as well as the overall development of a country (Ayua et al., 2023). Scientific literacy is seen as not only a benefit but a necessity. As a result of this, Basic Science is a mandatory course at basic education. The growth of any country is directly linked with the education development. Specifically in relation to upper basic education, this is a transition between middle basic school and the post-basic (senior secondary) school which is, in its turn, the provider of tertiary education which, in its turn, requires a manpower that is necessary to develop the nation (Ayua et al., 2025). Scientific and technological changes are causing phenomenal change in the world. To stay up to date with these technological shifts and utilize them to national development, teachers across the globe do not choose to follow past studies and outdated teaching techniques; instead, they are constantly interested in creating new and efficient methods to revolutionize the educational process with the help of catchy, attractive, and natural ways to teach (Ada et al., 2020).

Basic Science, previously referred to as Integrated Science or Primary Science, represents the initial exposure to science education that children encounter at the elementary level of education. According to Ayua et al. (2021), Basic Science constitutes a core subject within the curriculum of a nation at the basic education stage. All students in Basic 7 to 9 classes are required to study this subject, which serves as the foundational bedrock for successful and effective science education at the senior secondary school level. The subject equips learners at the upper basic level with the necessary preparation for pursuing the specialized core science subjects such as Biology, Chemistry, and Physics at the senior secondary level. Thus, a successful engagement with these subjects at the senior secondary school stage requires students to be vast in Basic Science during their upper basic education (Ayua et al., 2023).

Accordingly, Students who demonstrate strong performance in Basic Science are typically encouraged and permitted to enrol in science subjects at the secondary level (Agogo & Ode, 2017). Basic Science is designed as a comprehensive course that presents the science discipline in its full diversity and ramifications as a unified whole, thereby enabling learners to appreciate the interdependence among all scientific fields (Ayua & Jato, 2012). The scholars upheld that, the knowledge acquired through this subject holds significant relevance for human beings' comfortable and sustainable living within their environment. Furthermore, Basic Science promotes the active examination of student's surroundings. Therefore, teachers of the subject often engage in continuous learning alongside students. The pedagogy of science at basic level is rooted in the philosophy of active learner participation, wherein students are encouraged to construct their own understanding by building connections between new information and their existing knowledge, with the teacher serving primarily as a guide or facilitator in this process.

The Mini-Anchor-Chart Strategy (MACS) represents a learner-centred instructional approach that employs small or reduced-size anchor charts within classroom teaching to promote meaningful learning and heightened student engagement (Ashley, 2021). As a scaled-down variant of traditional anchor charts, it serves as a visual aid that encapsulates the core principles of a lesson, enabling students to apply these principles independently during self-study (Ayua et al., 2025). Consequently, MACS functions as a deliberate pedagogical technique that utilizes compact, collaborative visual supports to organize subject matter, stimulate interest, and enhance comprehension of essential concepts. The strategy renders learning more accessible and manageable for learners by focusing on specific elements rather than broad overviews. Mini-anchor charts may therefore be prepared either by the instructor or collaboratively by students and can be presented on classroom boards or tables for easy reference. This method proves particularly beneficial for visual learners and individuals with special educational needs, as it aids in the retention and understanding of information. Furthermore, the Mini-Anchor-Chart Strategy is adaptable across various educational levels (Smith & Johnson, 2020). It encourages active participation, fosters the development of personal knowledge construction, and empowers students to pose questions and seek clarifications.

The academic performance is seen to be the most important aspect of an educational system globally since it defines whether or not any academic institution is a success or a failure. Academic performance is considered an observable or measurable behaviour of a person or group of persons in a given situation, usually in an experimental setting (Ada et al., 2020; Ayua et al., 2023). In this research, it can be defined as the scores of students based on the test performance in the Basic Science. Poor performance by students has been mostly blamed on ineffective and teaching strategies or methods (Ode et al., 2020). Teachers with a keen ability to build up on learners' experiences, abilities, interests, and skills find it easier to achieve high performance. The quality of teaching in the classroom also affects the students' performances in Basic Science. Basic Science teachers and pupils should cooperate completely and be devoted to teaching and learning to ensure successful learning. It is the mandate of education authorities thus, and more so, of Basic Science teachers, to assume responsibilities of implementing and fostering pedagogical interventions that would boost the scores of students in Basic Science, despite the variations in the rates of their learning capabilities.

Learning rapidity can be defined as the rate and efficiency in which a student learns new knowledge or skills. It forms one of the essential parts of the educational process since it determines the speed and competence with which a student is able to absorb new information and apply it effectively (Marks, 2016). The rate of learning could be affected by factors such as age, intelligence level, and previous knowledge of the learner, the environment, the contents of the learning delivered by the teacher, and the quality of learning resources (Hostetler, 2023). In cases where academically similar learners are taught in similar classrooms, teaching should consider the difference in the speed at which the learners learn (Dharani et al., 2022). Despite the fact that every learner has his or her own pace of learning and processing of information, there are generally three types of students according to their rate of learning: slow learners, passive or average learners and quick learners (Joseph & Abraham, 2023).

Related empirical researches have been done to determine the effectiveness of the innovative instructional techniques on students' academic performance in Basic Science. Ayua et al. (2023) examined how "ethno-science instruction influenced the academic performance (in science) of upper basic students who had different reasoning abilities". They found that students who were taught in the ethno-science approach scored much higher in terms of academic performance as compared to their counterparts who were exposed to lecture method. However, there were no significant differences in the academic performance of the students with different reasoning abilities when ethno-science was utilized. Agbidye et al. (2023) conducted research in a related study which examined "the impact of anchored teaching method on the performance of students in Basic Science in upper basic schools in Makurdi". The findings revealed that students who received anchored instruction performed academically better in comparison to those in the lecture method. In a similar manner, Ayua et al. (2021) determined "effective teaching on the performance of varied-ability students in the upper domain in Makurdi, Nigeria, have found that there were significant differences in performance between the creative-teaching group and the lecture method group; with the performance being favourable to the former. Nonetheless, there were no notable disparities in performance of the diverse-ability pupils instructed using creative instruction.

Moreover, the impact of teaching under activity-based techniques in Basic Science on students was investigated by Green (2024). It was discovered that those students who were taught through activity-related methods showed significantly better academic performance than the students who were taught through the lecture method. The experimental group showed a higher average increase in achievement, which implies that field exercises and active-learning activities lead to better learning and remembering of scientific concepts.

Statement of the Problem

The significance of science and technology in the growth of a nation such as Nigeria cannot be overstated. These disciplines constitute foundational pillars for socio-economic and infrastructural advancement in any country. This understanding explains the Nigerian government's substantial emphasis on the objectives of basic education, which encompass enabling students to attain high levels of performance in science and technology, acquire essential knowledge and skills in these domains, apply scientific and technological principles to address societal challenges, exploit the wide range of career opportunities offered by science and technology (Ayua et al., 2023), and prepare effectively for advanced studies in scientific and technological fields.

Notwithstanding, the critical importance of science, the challenge of effectively learning Basic Science continues to pose a significant barrier to harnessing science for national development. Numerous studies have linked students' persistent difficulties in mastering science evident in consistently poor performance in the subject to ineffective instructional practices (Agbidye et al., 2023; Pramesti et al., 2020). This trend of underperformance has steadily worsened over time. An analysis of students' results in Basic Science in the Basic Education Certificate Examination (BECE) from 2019 to 2024 reveals a consistent increase in the failure rate: 5.63% in 2019, 8.52% in 2020, 9.72% in 2021, 11.26% in 2022, 12.61% in 2023, and 13.50% in 2024 (Cross River State Examination Board, 2024). The situation is primarily attributed to ineffective teaching methods used by Basic Science instructors, alongside other contributing factors (Ayua et al., 2023). The present study aims to examine the impact of the MACS on the academic performance of Basic-8 students with varying learning speeds in Basic Science in Obudu, Cross River State. Within this basis, the following specific objectives were formulated: to compare the academic performance of Basic Science students taught using the MACS with those taught using the expository teaching strategy, and to examine the academic performance of Basic Science students taught using the Mini-Anchor-Chart Strategy according to their learning speed.

Research Questions

The following research questions formulated guided the study:

1. What is the mean difference in academic performance scores between students taught Basic Science using the MACS and those taught using the Expository Teaching strategy?
2. What is the mean difference in academic performance scores of Basic Science students taught using the MACS across different levels of learning rapidity?

Hypotheses

The following null hypotheses were tested:

1. The mean academic performance scores between students taught Basic Science using MACS do not significantly differ from those exposed to expository teaching strategy.
2. The mean academic performance scores among students taught Basic Science with MACS do not significantly differ depending on their learning rapidity.

Materials and Methods

The study adopted a pre-test–post-test non-randomized quasi-experimental control group design. This research design was selected for two primary reasons. First, it enables researchers to assess the effectiveness of an intervention by comparing outcomes between a treatment group and a control group while controlling for pre-existing differences between the groups (Campbell & Stanley, 1963). Second, it serves as a practical and ethical alternative when "random assignment of participants to groups is not feasible, thereby facilitating the evaluation of intervention effects and enhancing the generalizability of findings to real-world educational settings" (Emaikwu, 2021). The population of 3,048 students in basic 8 in public schools in the 32 schools located in Obudu LGA, Cross River State. The sample consisted of two intact classes involving 68 Basic 8 students which were divided into two group: an experimental group and a control group. Each group with n = 34 respectively. A multistage sampling technique was adopted, incorporating stratified, purposive, and simple random sampling procedures. Based on learning rapidity, the experimental group comprised 12 fast learners, 12 moderate learners, and 10 slow learners, while the control group included 11 fast learners, 14 moderate learners, and 9 slow learners. The classification of students according to learning rapidity was determined using the Students Learning Rapidity Classification Quiz (SLRCQ) (Ayua et al., 2025).

Data were collected using the Basic Science Performance Test (BSPT), which was adopted from past Basic Education Certificate Examination (BECE) questions on the topics: Work, Energy, and Power; sourced from the Cross River State Examinations Board (2020 - 2024). The instrument consisted of 25 multiple-choice objective questions with A, B, C, and D options respectively. Each correct answer was awarded one mark, for a total possible score of 25. The BSPT was administered as both a pre-test and a post-test to students in the experimental and control groups. Data analysis involved the use of Analysis of Covariance (ANCOVA) to test the null hypotheses at a significance level of p = 0.05. Descriptive statistics (means and standard deviations) were employed to answer the research questions.

Results

The results are presented in line with the research questions and hypotheses:

Question 1: Table 1: The standard deviation and mean of academic performance of students, depending on the teaching method.

Method	**Sample (n)**	**Pretest**		**Post-test**		**Gain**	**Mean Gain Difference**
		Mean	**St. D**	**Mean**	**SD**		
MACS	34	13.88	2.59	21.29	1.87	7.41	5.27
Expository Teaching	34	13.21	2.28	15.35	1.63	2.14	

As presented in Table 1, students taught using the MACS achieved a pre-test mean score of 13.88 (SD = 2.59) and a post-test mean score of 21.29 (SD = 1.87). In contrast, students instructed through the Expository Teaching (ET) strategy obtained a pre-test mean score of 13.21 (SD = 2.28) and a post-test mean score of 15.35 (SD = 1.63). The MACS group recorded a mean gain score of 7.41, compared to 2.14 for the ET group. This resulted in a mean gain score difference of 5.27 points in favour of the Mini-Anchor-Chart Strategy. These findings indicate that students exposed to the Mini-Anchor-Chart Strategy demonstrated substantially greater improvement in academic performance than those taught using the Expository Teaching strategy.

Question 2: What is the mean difference in the academic performance scores of students taught Basic Science using MACS based on learning rapidity?

Table 2: Mean and Standard Deviation of Academic Performance Scores of Students with Different Learning Rapidity Taught Basic Science using MACS

Learning Rapidity	Sample (n)	Pre-test		Post-test		Mean Gain	Mean Gain Difference
		Mean	St. D	Mean	St. D		
Slow	10	11.00	1.49	20.10	1.45	9.10	
Moderate	12	13.42	0.90	20.92	0.90	7.50	1.60 ≤ 3.77
Fast	12	16.67	1.16	22.00	1.28	5.33	

As presented in Table 2, the performance of students taught Basic Science using the MACS varied across learner categories as follows: Slow learners attained a pre-test mean score of 11.00 (SD = 1.49) and a post-test mean score of 20.10 (SD = 9.10). Moderate learners achieved a pre-test mean score of 13.42 (SD = 0.90) and a post-test mean score of 20.92 (SD = 0.90). while the fast learners obtained a pre-test mean score of 16.97 (SD = 1.16) and a post-test mean score of 22.00 (SD = 1.28). Furthermore, Table 2 reveals that the mean gain scores for learners taught using the Mini-Anchor-Chart Strategy were 5.33 for slow learners, 7.50 for moderate learners, and 9.10 for fast learners. The differences in mean gain scores among the three categories of learning speed ranged from 1.60 to 3.77.

Hypothesis One: The mean academic performance scores between students taught Basic Science using MACS do not significantly differ from those exposed to expository teaching strategy.

Table 3: ANCOVA of Students' Academic Performance Based on Teaching Method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	668.236[a]	2	334.118	161.294	.000	.832
Intercept	334.159	1	334.159	161.314	.000	.713
Pretest	68.177	1	68.177	32.912	.000	.336
Teaching	**533.933**	**1**	**533.933**	**257.754**	**.000**	**.799**
Error	134.646	65	2.071			
Total	23634.000	68				
Corrected Total	802.882	67				

a. R Squared = .832 (Adjusted R Squared = .827). b. Computed using alpha = .05

As shown in Table 3, the ANCOVA results indicate an F-ratio of $F(1, 65) = 257.754$, with a p-value of 0.000, which is below the 0.05 significance level. Accordingly, the null hypothesis was rejected. This outcome demonstrates a statistically significant difference in the adjusted mean academic performance scores between students taught Basic Science using the MACS and those instructed through the Expository Teaching (ET) strategy. The findings confirm that the Mini-Anchor-Chart Strategy leads to substantially higher academic achievement in Basic Science than the Expository Teaching approach. In addition, the partial eta squared value ($\eta^2 = 0.799$) indicates a large effect size, signifying that the Mini-Anchor-Chart Strategy explains approximately 79.9% of the variance in students' academic performance and highlighting its strong practical significance

Hypothesis Two: The mean academic performance scores among students taught Basic Science with MACS do not significantly differ depending on their learning rapidity.

Table 4: ANCOVA of Students' Academic Performance Based on Learning Rapidity)

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	21.328[a]	3	7.109	4.787	.008	.324
Intercept	80.497	1	80.497	54.201	.000	.644
Pretest	1.262	1	1.262	.850	.364	.028
Learning Rapidity	**.953**	**2**	**.477**	**.321**	**.728**	**.021**
Error	44.555	30	1.485			
Total	15144.000	34				
Corrected Total	65.882	33				

a. R Squared = .324 (Adjusted R Squared = .256). b. Computed using alpha = .05

As presented in Table 4, the ANCOVA results show an F-ratio of F (2, 30) = 0.321, with a p-value of 0.728, which is greater than the 0.05 significance level. Therefore, the null hypothesis was not rejected. This finding indicates no statistically significant difference in the adjusted mean academic performance scores among students taught Basic Science using the MACS, regardless of variations in their learning rapidity. The outcome supports the conclusion that the MACS instructional approach is equally effective across different categories of learning speed, as it produces no significant disparities in academic achievement based on this factor. Furthermore, the partial eta squared value (η^2 = 0.021) reflects a small effect size, suggesting nearly equivalent improvements in mean academic performance among slow, moderate, and fast learners when taught with MACS. This implies that only about 2.1% of the variance in students' academic performance is attributable to differences in learning rapidity, consistent with the lack of a significant effect.

Discussion

With regards to academic performance of students according to teaching method, the findings were that the Mini-Anchor-Chart Strategy (MACS) improved the performance of students in Basic Science between the MACS and the Expository Teaching (ET) and the ANCOVA test gave a significant outlook that the difference is significant. It is possible that the desired situation between the student taught with the use of MACS and the control group was instigated by the fact that opportunity gives members the chance to interact, exchange ideas and have their misunderstandings rectified instantly by their peers, as a result of which, students understand scientific concepts better. This result is in line with Agbidye et al. (2023), Ayua et al. (2023) and Green (2024), who discovered that, students who were learning certain basic aspects of science with the help of constructivist teaching strategies did substantially better in terms of the academic performance scores than students who were taught by conventional teacher-centred teaching methods. This observation of the current study is not unfamiliar as the students were more comfortable with their responses during the MACS classes, and they took more initiative in the discussions that occurred during the classes and in meaningful communication via the anchor charts.

Concerning the academic performance of students when measured in terms of learning rapidity, the results exhibited no significant difference in mean scores in academic performance among the different learning rapidity students who were taught Basic Science by MACS. The implication of this is that the performance of students studying Basic Science can be homogenously improved regardless of the differences between their learning speed when taught with MACS. The reason behind this is students learn at their own pace via MACS; that is, students regardless of their speeds of learning are allowed to generate ideas, systematize information and articulate as well as challenge the ideas in the process of learning and because these learners are able to comprehend scientific concepts in a better manner, hence the performance levels of students are raised to immeasurable proportions. This result resembles the no difference in the academic performance of varied-ability students taught Basic Science with the help of Creative-Teaching discovered by Ayua et al. (2021). There is also the similarity of the finding with that by Ayua et al. (2023), who had determined that epistemic ability among students with different reasoning ability did not significantly differ in terms of the scores of the academic performance in the usage of ethno-science teaching approach to teach the students the academic current topic of Basic Science.

Conclusion

As the results of the research revealed, the conclusion was made that the Mini-Anchor-Chart Strategy (MACS) in the performance of students in Basic Science is homogeneous, regardless of their learning speed differences.

Recommendations

In this regard, the following recommendations were made:

1. Teachers should adopt the MACS to make the teaching and learning of Basic Science in Nigerian basic education more meaningful and effective.
2. the Ministry of Education at all levels should actively promote the use of the MACS among Basic Science teachers by organizing and sponsoring workshops, conferences, and refresher courses. Such professional development programmes will equip teachers with the necessary skills to implement the strategy and enhance classroom instruction.
3. Heads of Basic Science should be encouraged to observe that the MACS significantly improves students' academic performance irrespective of differences in learning rapidity. Accordingly, they should actively support and promote the adoption of this instructional approach to elevate the overall standard of student achievement in Basic Science.

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