EFFECT OF MINI-ANCHOR-CHART STRATEGY ON INTEREST OF DIFFERENT REASONING ABILITY BASIC 8 STUDENTS IN BASIC SCIENCE IN CROSS RIVER STATE

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Abstract

This study examined the effect of Mini-Anchor-Chart Strategy on Interest of different reasoning ability Basic 8 Students in Basic Science in Obudu, Cross River State. Two research questions and two hypotheses guided the study. A pre-test post-test quasi-experimental control group research design was used. Out of the 3,048 Basic 8 Students in the 32 Government schools in Obudu, 68 were drawn from intact classes of two schools using a multistage sampling. Basic Science Interest Scale (BSIS) with reliability of 0.916, was used for data collection. Cronbach's Alpha was used to determine the reliability coefficient of the BSIS. Mean and standard deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the null hypotheses at 0.05level of significance. The findings of the study showed that, there is a significant difference in the interest level between students taught Basic Science using Mini-Anchor-Chart Strategy and Expository Teaching in favour of MACS. However, there was no significant difference in the interest level of students taught Basic Science using MACS based on reasoning ability. Therefore, it was recommended among others that Mini-Anchor-Chart Strategy be used for Science Teaching at the Upper basic education level.

Keywords: Mini-Anchor-Chart Strategy (MAC), Basic Science, Interest and Reasoning Ability.

Introduction

The relevance of Science Education cannot be over emphasized. This is because Science Education plays a central role in the development and empowerment of citizens and the Nation at large. Being scientifically literate will no longer be just an advantage but also an absolute necessity, thereby making Basic Science a compulsory subject at basic education level (Samuel, 2014). The development of any nation is connected to the educational system in operation, with specific reference to the basic education. It is the intermediary between primary and tertiary education which is responsible for the production of manpower for the overall development of a nation. Advances in Science and Technology are transforming the world in an incredible manner. To actualize this technological advancement, educators do not rest on the oars of their previous researches and conventional teaching strategies but they should keep searching for novel and ideal ways on how to transform education through an engaged, appealing, intuitive pedagogy or domain (Ada et al., 2020).

The need for this transformation could be the reason why the Federal Republic of Nigeria (FRN, 2014), in release of her educational objectives for the basic education level, emphasizes on the need to equip students with relevant skills to live effectively in the modern age of Science and Technology. Science generally is a body of knowledge which deals with nature. It is part of our daily lives ranging from cooking and gardening to recycling and comprehending the daily weather report to reading a map and using a computer (Odoh & Ajio, 2021).

Basic Science formerly known as Integrated Science and as Primary Science in the lower basic education level is defined as the study of matter, living things and non-living things. It is the first form of science a learner comes across at the lower basic school level. Basic Science is a course of study which presents science discipline in all its ramifications or diversity, in a unit whole so as to appreciate the interdependence of all science disciplines (Ayua, & Jato, 2012; Agogo & Ode, 2017). The authors maintained that, the knowledge gained is relevant for man's comfortable living in his environment. Basic Science lays the foundation for core science subjects such as Biology, Physics and Chemistry which in turn form the bedrock to understanding and carrying out advanced studies in science (Adeniran et al., 2018). This implies that the success or failure in science studies at the post-basic and higher school levels is likely and largely dependent on Basic Science. Ayua (2012), and Ode and Tartenger (2021) observed that despite of the importance of Basic Science, the teaching and learning of the subject is faced with some challenges inhibiting the fulfilling of its laudable goals; most of which are attributed to inappropriate teaching strategies. To this end, teachers are expected to devise ways of improving the teaching of Basic Science by utilising learner-centred teaching strategies.

Mini-Anchor-Chart Strategy (MACS) is a learner-centred teaching strategy that uses compact or simplified anchor charts during classroom instruction to enhance learners' meaningful engagement and effective learning. It is a miniature of the traditional anchor chart used to reinforce key concepts during teaching. It is a visual representation that states the principle of the lesson for the students as they apply the principle in their own independent study (Ashley, 2021). Thus, it is a targeted teaching approach using compact, collaborative visual tools to organize content, boost engagement, and enhance understanding of key concepts. By focusing on specific topics, it makes learning more manageable and accessible for students. Mini-Anchor-Charts can be created by the teacher or by the students and they can be displayed on a board or table in the classroom. This method is especially useful for visual learners and for students who need additional support to understand and retain information. Mini-Anchor-Charts Strategy can be used at all levels of instruction (Smith & Johnson, 2020). It promotes active learning and encourages students to construct their own understanding of the concepts being taught. It is believed that this method will help students to learn by enabling them ask questions and get answers which can enhance students' interest in science subjects as compared to other conventional teaching methods.

Interest is a feeling of concern or desiring to know or learn about concepts in Basic Science. Students' interest can be seen in the expression of enthusiasm and commitment in the classroom and as a matter of choice, engagement in activities within their subject area even outside the class time (Kira & Nchunga, 2015). It helps in sustaining concentration, purpose, commitment and co-operation with the teacher in the learning process which improves their reasoning ability (Danjuma, 2015).

Reasoning ability is the ability of one to assess things rationally by applying logic based on new or existing information when making a decision or solving a problem. According to Hooda et al. (2018), reasoning abilities are the core competencies of students that enable them to cope with the difficulties in life, solve problems and manage complexity and to survive under a variety of conditions. This ability enables the students to find out the cause-and-effect relationship. The reasoning ability of a child depends on the mental development as the child grows. Piaget (1957) postulated four levels of cognitive development one must pass through which are; sensory, pre-operational, concrete, and formal operational stage. He also postulated a transitional stage from concrete to formal. At the upper Basic levels of education, learners correspond to the concrete, transitional or formal reasoning abilities. Transitional reasoning ability also refers to as the formal operational stage, is a stage of cognitive development described by Piaget (1957). Transitional reasoning involves the ability to think abstractly, hypothetically and systematically about complex ideas and concepts. The transitional stage of cognitive development is a stage that links the concrete stage to the formal operational stage, hence, the name "transitional". The child is now able to deal with more than the concrete real situations of the previous stage. He can think logically about things, and can also reason without inferring to concrete objects.

Based on the empirical reviews, Darrow and Lynch (2021), in their study "Using Visual Learning Tools to Improve Science Comprehension in Middle School Learners", the study examined the impact of visual learning aids; specifically mini-anchor charts and graphic organizers on students' comprehension and interest in science, conducted in California. The authors concluded that visual strategies such as mini-anchor charts enhance cognitive processing and learner engagement. Vasquez and Moreno (2023) conducted an experimental study titled "Enhancing Student Engagement and Performance in STEM Using Mini Anchor Charts." Results indicated that students in the mini-anchor chart group significantly outperformed the control group on the STEM and reported higher levels of engagement and interest. It was also discovered from literature that students taught Basic Science concepts using Mini-Anchor Chart Strategy performed better than their counterparts taught using traditional teaching methods.

These empirical studies were related to the present study based on variables like Mini-Anchor-Chart, interest and Basic Science. However, the studies were of different locations, populations, sample sizes and different cultural backgrounds, thus the reason for this current study.

Statement of the Problem

In a developing country like Nigeria, the importance of Science and Technology cannot be overemphasized, as Science and Technology provide the basis for sound socio–economic and structural development of any country. However, difficulty in learning Basic Science has been established by a number of research works (Ayua & Eriba, 2014; Pramesti et al., 2020; Woldeamanuel et al., 2014), describing the subject as being difficult, complex, and abstract for students at the basic education level. Lack of conceptual understanding has been identified as one of the major reasons for students' lack of interest in the subject which is often attributed to poor teaching methods (Gongden & Delmang, 2016). Also, studies of Akpan and Ekpo (2021), Ayua et al. (2025), Eze and Nwankwo (2023), and Okechukwu and Opara (2021), revealed that lack of students' interest in a subject is caused by uninteresting and inappropriate teaching strategies used by teachers in delivering lessons. It is against this backdrop that study was necessitated with objectives to:

1. Ascertain the effect of Mini-Anchor-Chart strategy on students' interest in Basic Science.
2. Establish the effect of Mini-Anchor-Chart strategy on students' interest in Basic Science based on reasoning ability.

Research Questions

The following research questions guided the study:

1. What is the difference between the interest level of students taught Basic Science using Mini-Anchor-Chart Strategy and those taught using Expository Teaching?
2. What is the difference among the mean interest levels of students taught Basic Science using Mini-Anchor-Chart Strategy based on reasoning ability?

Hypotheses

The study had the following hypotheses:

1. There is no significant difference between the interest levels of students taught Basic Science using Mini-Anchor-Chart Strategy and those taught using Expository Teaching.
2. There is no significant mean difference among the interest levels of students taught Basic Science using Mini-Anchor-Chart Strategy based on reasoning ability.

Method

The study was conducted using a pretest post-test non-randomized quasi-experimental control group research design. The research design was adopted for two primary reasons. Firstly, this design allows researchers to assess the effectiveness of an intervention or treatment by comparing the outcomes between a treatment group and a control group, while accounting for potential pre-existing differences between the groups (Campbell & Stanley, 1963). Secondly, in situations where random assignment of participants to groups is not feasible or ethical, this design provides a viable alternative for evaluating the impact of an intervention, thereby increasing the generalizability of findings to real-world settings (Shadish et al., 2002; Emaikwu, 2021).

The population of the study consisted of 3,048 Basic 8 students in the 32 Government Secondary Schools in Obudu Local Government Area of Cross River State. A sample of 68 Basic 8 students in the selected Government schools was used for the study, 34 each for experimental and control groups respectively. This sample size is considered adequate because the study is experimentally oriented where less emphasis is placed on large sample size.

The sampling was done using multi-stage sampling (stratified, purposive and simple random sampling). Multistage sampling was used to select 68 Basic 8 students for the study. Out of the different number of schools within the local government (private and government owned secondary schools), the government owned schools were selected using stratified sampling. The choice of the schools was based on Government ownership with the same curriculum and quality of teachers. In order to achieve this, the schools were grouped into two regions (northern and southern) of Obudu, with 18 schools in the northern region and 14 in southern region. Secondly, schools with standard class size with at least a teacher that holds first degree in Integrated Science or any Science related discipline with Post Graduate Diploma in Education (PGDE), using the current Basic Science curriculum were purposively selected from these regions. From the above characteristics, 12 schools met the requirement, 7 from the northern region and 5 from southern region. Thereafter, the names of the schools in these regions were written in small pieces of papers and two students were made to pick at random one school from each of these regions. Random sampling technique was used to place the schools with intact classes into experimental group and control group by writing 1 (Experimental) and 2 (Control) on small pieces of papers that were folded and put into a basket. The school that picked 1 was placed in the experimental group and the one that picked 2 was placed in the control group respectively.

Based on reasoning ability, the experimental group had 12 high, 14 average and 8 low while the control group had 9 high 15 average and 10 low. The grouping of students was determined by administering the Students' Reasoning Ability Classification Quiz (SRACQ), data collected was computed using statistical mean.

The instrument used for data collection is the Basic Science Interest Scale (BSIS). Basic Science Interest Scale (BSIS): is a rating scale developed by the researcher to ascertain the interest level of the students for both control and experimental group of students. The BSIS is a 20-item Likert type scale instrument with four responses of High Interest Level (HIL = 3), Average Interest Level (AIL = 2), Low Interest Level (LIL = 1), and No Interest (NI = 0), from which respondents in the experimental and control groups chose the option they deemed best. The instrument was validated by two experts in Science Education and one expert in Mathematics Education at Rev. Fr. Moses Orshio Adasu University, Makurdi. Their inputs were sought in terms of adequacy of the instrument, soliciting the desired response, relevance of instrument to the purpose of the study, structure and grammatical construction of the instrument. The reliability of the BSIS was trial tested using 27 students from one of the secondary schools that is not part of the actual sample for the study. Cronbach's Alpha statistic was used in determining the reliability of the Basic Science Interest Scale with a value of 0.916.

Results

The results are presented in the order of research questions and hypotheses as following:

Research Question One: What is the difference between the interest level of students taught Basic Science using Mini-Anchor-Chart Strategy and those taught using Expository Teaching?

Table 1: Mean and Standard Deviation of Students' Interest Level based on Teaching Methods

Method	Sample (n)	Pre- Interest		Post-Interest		Gain	Mean Gain Difference
		Mean	St. D	Mean	SD		
MACS	34	25.12	6.37	42.65	3.69	17.53	17.41
Expository Teaching	34	25.18	6.31	25.06	6.18	0.12	

The results in Table 1 revealed that students taught Basic Science using Mini-Anchor-Chart Strategy (MACS) had interest level mean scores of 25.12 with a standard deviation of 6.37 in the Pre-interest and interest level mean scores of 42.65 with a standard deviation of 3.69 in the post-interest. Students taught Basic Science using Expository Teaching (ET) had interest level mean scores of 25.18 with a standard deviation of 6.31 in the Pre-interest and interest level mean scores of 25.06 with standard deviation of 6.18 in the post-interest correspondingly. Table 1 further showed that students taught using MACS had mean gain interest scores of 17.53 while those taught using ET had a mean gain interest score of 0.12. Thus, there was a mean gain difference of 17.41in favour of students taught Basic Science using Mini-Anchor-Chart Strategy (MACS). This showed that students taught using MACS increased interest level more as compared to those taught using ET.

Research Question Two: What is the difference among the mean interest levels of students taught Basic Science using Mini-Anchor-Chart Strategy based on reasoning ability?

Table 2: Mean and Standard Deviation of Interest Levels of Students with Different Reasoning Abilities Taught Basic Science using Mini-Anchor-Chart Strategy

Reasoning Ability	Sample (n)	Pre-Interest		Post-Interest		Mean Gain	Mean Gain Difference
		$\bar{x}$	SD	$\bar{x}$	SD		
Low	9	27.89	6.53	41.33	3.32	13.44	
Average	13	27.23	5.96	42.00	1.73	14.77	$0.14 \leq 1.33$
High	12	28.42	7.04	42.00	2.89	13.58	

The result in Table 2 revealed that low reasoning ability students taught Basic Science using Mini-Anchor-Chart Strategy (MACS) had interest level mean scores of 27.89 with a standard deviation of 6.53 in the post-interest and interest level mean scores of 41.33 with a standard deviation of 3.32 in the post-interest. Average reasoning ability students taught Basic Science using Mini-Anchor-Chart Strategy (MACS) had interest level mean scores of 27.23 with a standard deviation of 5.96 in the post-interest and interest level mean scores of 42.00 with a standard deviation of 1.73 in the post-interest. High reasoning ability students taught Basic Science using Mini-Anchor-Chart Strategy (MACS) had interest level mean scores of 28.42 with a standard deviation of 7.04 in the post-interest and interest level mean scores of 42.00 with a standard deviation of 2.89 in the post-interest. Table 2 showed that low, average and high reasoning ability students taught using MACS had mean gain scores of 13.44, 14.77 and 13.58 respectively. Table 2 finally, showed a mean gain difference of the reasoning ability students which falls within the range of $0.14 \leq 1.33$.

Hypotheses One: There is no significant difference between the mean interest level of students taught Basic Science using Mini-Anchor-Chart Strategy (MACS) and those taught using expository method.

Table 3: ANCOVA Summary of Students' Interest Level Based on Teaching Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5474.797[a]	2	2737.398	119.118	.000	.786
Intercept	2814.444	1	2814.444	122.471	.000	.653
Pre-interest	215.914	1	215.914	9.396	.003	.126
Teaching Method	**5268.803**	**1**	**5268.803**	**229.273**	**.000**	**.779**
Error	1493.733	65	22.981			
Total	84898.000	68				
Corrected Total	6968.529	67				

a. R Squared = .786 (Adjusted R Squared = .779)
b. Computed using alpha = .05

The ANCOVA statistic summary in Table 3 shows that F (1,65) = 229.273; ρ = 0.000 < 0.05. This suggests that the probability level is less than the specified alpha of 0.05. Therefore, the null hypothesis was rejected. This means that there was a significant difference in the increase of interest level mean scores of students taught using MACS and those taught using the ET in Basic Science. This implies that MACS significantly increases students' interest level more than ET in Basic Science. The partial eta squared value of 0.779 was considered as a large effect size, indicating that the MACS has a substantial impact on students' interest level. This means that approximately 77.9% of variance in students' interest levels can be attributed to the difference between the two teaching methods.

Hypotheses Two: There is no significant mean difference among the interest level of students taught Basic Science using Mini-Anchor-Chart (MACS) based on reasoning ability.

Table 4: ANCOVA Summary of Students' Interest Level Based on Reasoning Ability

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4.022[a]	3	1.341	.187	.904	.018
Intercept	2918.792	1	2918.792	407.427	.000	.931
Pre-interest	1.081	1	1.081	.151	.700	.005
Reasoning Ability	**2.926**	**2**	**1.463**	**.204**	**.816**	**.013**
Error	214.919	30	7.164			
Total	59692.000	34				
Corrected Total	218.941	33				

a. R Squared = .018 (Adjusted R Squared = -.080)

The ANCOVA statistic summary in Table 4 shows that F (2, 30) = 0.204; ρ = 0.816> 0.05. This affirms that the probability level is greater than the specified alpha of 0.05. Therefore, the null hypothesis was not rejected. It specifies that there was no significant difference in the interest level mean scores among students with different reasoning ability taught Basic Science using MACS. This elucidates that MACS is effective for different reasoning ability and no reasoning ability-based disparities in learning outcomes of students. The partial eta squared value of 0.013 is considered as very small effect size, signifying equivalent development of interest level mean scores of students with different reasoning ability taught using MACS. This indicates that approximately 1.3% variance of students' interest level can be attributed to no statistically significant difference among students with different reasoning abilities.

Discussion of Findings

Findings of this study revealed that students taught Basic Science using Mini-Anchor-Chart Strategy (MACS) gained more interest level compared to those taught Basic Science using Expository Teaching (ET). The ANCOVA test summary showed that the difference was significant. The significant difference recorded in the MACS group over ET might be due to the fact the MACS provide opportunities for all students to collaborate, engage in independent reading, actively participate, interact with charts and with one another during the lesson delivery. Thus, increasing interest to learn meaningfully for lasting functional education. However, such an opportunity was lagging in the ET where students simply learnt passively.

This study corroborates with previous studies like Tofi et al. (2024) whose studies revealed significant difference in the interest rating of students exposed to peer tutoring strategy and their counterparts taught using conventional method. The study agrees with Okechukwu and Opara (2021) who found a significant difference in interest scores of students exposed to Basic Science and Technology using team teaching strategy and their counterparts exposed to Basic Science and Technology using conventional teaching strategy. The study also agrees with that of Akpan and Ekpo (2021) whose findings revealed that students taught using concept mapping demonstrated higher interest in Basic Science compared to those taught using conventional methods. This study also aligns with studies of Yusuf and Bello (2020) whose findings suggested that students exposed to problem-based learning exhibited higher interest in science subjects than those taught using conventional methods.

The second findings revealed that there was no significant difference in the interest level mean scores among students with different reasoning ability taught Basic Science using MACS. The findings may be explained that MACS is student-centred as such provide an opportunity for students to share their ideas, actively participate and collaboratively think in response to new information by so doing carter for different reasoning ability students. The findings in this study disagrees with Adeyemi and Ogundele (2022) who found that students with high reasoning skills performed better in science subjects than the students who have low reasoning skills. The study disagrees with Achor and Ayuba (2015) that knowledge retention of high and low reasoning ability level students significantly differed in favour of high ability students. This could be possible due to difference in location, culture, methodology and sample of the selected students. This also disagrees with the study of Bello and Ibrahim (2023) that there is a significant difference in the reasoning ability levels of students.

Conclusion

Sequel to the findings, the study conclusively shows that Mini-Anchor-Chart Strategy (MACS) is a game-changer in boosting students' interest in Basic Science, outperforming traditional Expository Teaching methods. Notably, MACS benefits students of all reasoning abilities equally, making it an inclusive approach; which science teachers can leverage to create engaging, collaborative, and effective learning experiences that foster a lifelong passion for science among upper basic education students.

Recommendations

Based on the findings, the following recommendations were made:

1. Teachers should use Mini-Anchor-Chart Strategy to ensure meaningful and functional teaching and learning in Basic Science at the basic education level in Nigeria.
2. Ministry of Education at both the Federal and State level should encourage the use of Mini-Anchor-Chart Strategy among Basic Science teachers in the classroom by funding workshops, conferences and refresher courses for teachers to ensure meaningful teaching and learning.

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