
**EFFECT OF MNEMONIC INSTRUCTIONAL STRATEGY ON
ACADEMIC ACHIEVEMENT OF PUPILS IN BASIC SCIENCE:
IMPLICATION FOR SUSTAINABLE DEVELOPMENT**

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Abstract

Science and technology drive global development through discoveries and inventions. Despite the importance of science in human survival, less number of students are taking to science courses due to fear occasioned by poor performance in the basic sciences, which seems to have been orchestrated by poor teaching methods. This situation has resulted in lack of quality scientists in the country. Hence, this study investigated the effects of mnemonic instructional strategy on academic achievement of pupils in Basic Science in Enugu State, Nigeria. The study adopted a quasi-experimental pre-test, post-test non-equivalent control group research design. The sample of the study comprised 89 primary 5 pupils in two intact classes from two primary schools in Enugu Urban, Enugu state, Nigeria. Basic Science Achievement Test (BSAT) was developed by the researchers and used for data collection. The reliability index of the instrument was 0.87. Analysis of Covariance was used to analyze the data collected. The findings of the study revealed among others that mnemonic instructional strategy had a significant effect on academic achievement of pupils in Basic Science. It was also found that gender was not a significant factor in pupils' achievement in Basic Science. It was, therefore, recommended among others that teachers should endeavour to employ mnemonics instructional strategy in the classrooms for better academic achievement of pupils in Basic Science.

Keywords: Mnemonics, Instructional Strategy, Academic Achievement, Pupils, Basic Science, Sustainable Development.

Introduction

Assessment and the modes of assessing the extent of learners' academic achievements and abilities seem to be critical aspects of operative instructional planning that lead to positive learning outcomes. It seems that without effective assessment of learners' academic skills, it may be difficult to make academic judgements. Martens and Witt (2020) insisted that instructional decisions that are likely to promote academic competence could not be reached without an effective assessment of learners' academic skills.

In a global sense, there seem to exist two powerful ideologies of assessment during instructions: assessment for and assessment of learning. According to Jana (2017), assessment for and assessment of learning are two integral aspects of instructional strategy that enhance learners' academic skills. Assessment for learning is a form of formative

assessment carried out regularly within the instructional process to help the teacher understand the knowledge and skills of the learners in order to modify instructional strategy appropriately. Dubec (2019) maintained that the assessment of learning is a kind of summative assessment performed at the end of instructions and is mostly used to determine the extent to which the target of instruction was achieved.

Hence, assessment in education is a process through which the teacher receives feedback on the learning experiences of the pupils, makes valid judgements and provides individualized instructions where necessary. Okoro et al. (2017) pointed out that assessment makes it possible for the teacher to discover the pupil's achievements, needs, strengths and weaknesses and that a teacher can carry out assessments formally or informally. Formal assessment includes but is not limited to tests, projects and quizzes that are timed, invigilated, and scored, which provide the teacher with information about the academic achievement of the pupils. While informal assessment refers to casual questioning, listening and watching pupils' explanations and demonstrations, that are neither scored nor graded. Informal assessment aids the teacher in identifying the pupil's areas of weakness and where more instructions are needed. While formal assessment is planned and learners prepare in advance, informal assessment needs little or no advance preparations. Considering the benefits of assessment, therefore, pupils need to be frequently assessed especially in basic science.

Basic science is universally esteemed high due to the indispensable place of science in technology and industrial development. Basic science as a subject in primary school prepares the pupils for future scientific endeavours. Okenyi (2023) opined that basic science and mathematics are essential variables for the economic and cultural development of any nation. Basic science is a conglomeration of the introductory science disciplines of Chemistry, Physics, Biology and Mathematics (Sinha, 2016). This implies that basic science introduces the pupils to science courses. Belluz et al. (2016) pointed out that science is directly employed in providing solution to man's daily basic problems and challenges. However, the applicability and the significance of Basic Science in the overall development and economic growth of humanity notwithstanding, the abysmal poor performance of pupils in the subject is terrifying. Afuwape and Olugbuyi (2019) insisted that poor performance of pupils in basic science over the years has impacted negatively on Nigeria's economy and development of science and technology. Similarly, Ugwuanyi and Okeke (2020) lamented the unswerving poor performance of pupils in basic science, pointing out that the situation is becoming a nightmare for science educators in Nigeria. Furthermore, Ugwuanyi and Okeke opined that the method of teaching basic science in schools is the major contributor to the poor achievement of pupils in basic science, and so, suggested a model shift from the traditional method of chalk and talk method. One of the model methods of instruction is the mnemonic instructional strategy.

Mnemonics refers to memory aids that enable a person to retain some specific body of information, utilizing some specific strategies or processes that help such a person improve memory capacity. Mnemonics is a memory device that assists the learner in remembering some details or some chunk of materials and can come in the form of a phrase, acronym, poem, songs among others (Dagmawi, 2017). Okenyi and Ezema (2022) revealed that Mnemonic instructions can link new knowledge to previous information via visual or acoustic cues or both. Visual cues refer to the graphics and pictures created by the

teacher to link the past and present information in the mind of the learner. Employing mnemonic instructional strategy in teaching basic science may improve the pupils' reminiscence of the rubrics and ensure quick remembrance of essential information that may aid the learner's academic achievement in basic science. This implies that mnemonic instructional strategy inspires pupils to be imaginative, flexible, gain self-confidence and consequently gain the capacity and the skill to generate, identify and grasp the prevailing opportunities for sustainable development in learning.

Sustainable Development (SD) refers to the ability to achieve the needs of the current situation without jeopardizing the capacity or diminishing the opportunities to meet the needs of future circumstances. SD is a conscious developmental framework that could be continued for a period of time or indefinitely without any prejudice to the future (Mensa, 2019). This simply implies that SD means the consciousness that an action in one aspect of life produces some effects and consequences on others and so, guard against such consequences. According to the United Nations Educational, Scientific and Cultural Organizations ([UNESCO], 2017), there are five core objectives of SD: It must enhance the individual's appreciation of his cultural background as well as prepare the individual to absorb emerging information and data for resolving the challenges and problems of the ever-changing environment. It must be able to inculcate in the individual the capacity to interrelate meaningfully with other individuals and to value the need for human organizations. It must boost the flexibility and creative skill of the individual particularly in cultural and technological dominion. It must nurture in the individual those values such as honesty, selflessness, tolerance, dedication, hard work, and personal integrity that enhance good citizenship. It has to encourage the ethos of productivity by providing an enabling environment for individuals to realize the innovative prodigy in humans, apply such to the enhancement of the prevailing skills and techniques of accomplishment of definite tasks, and so, promote competence of individual and communal efforts.

Science is the underlying element of development. Engwa (2014) stated that science is the pivot of development and economic growth in the world. In terms of job creation and job opportunities, science is most needed, as good achievement in science translates to creative and flexible thinking. Skills, aptitude tests for promotions, placement and employment are made of questions based on sciences. The whole issue of healthy living and longer life expectancies, technological advancements, economic growth and sustainability are dependent on science (Rull, 2014). This indicates that the economic progress of a nation depends largely on its scientific development which cannot be attained without a sound and strong foundation in science education through basic science (Okenyi, 2023).

In a study on the use of mnemonic instructional strategy as an alternative approach to creative teaching in teaching chemistry in secondary schools Adepoju (2014), discovered that students taught chemistry using a mnemonics instructional strategy found it easy and more convenient to remember concepts than other students who were taught using conventional method. Similarly in a related study Okoro and Unamba (2020), discovered that pupils taught mathematics using mnemonics instructional strategy performed better in mathematic over their counterparts taught utilizing conventional strategy. Simanjuntak, (2017) in a related but different study discovered that there is a

significant improvement in mastering vocabularies by students through the use of mnemonics strategy than conventional methods.

Mocko et al. (2017) in a study also discovered that the use of mnemonics among tertiary students reduced anxiety and improved self-esteem and self-confidence among the students. Similarly, in a related study, Aston (2020) found that atypical children had rapid improvement when taught utilizing mnemonics instructional strategy than those taught using conventional method of teaching and that such students prefer to study longer than before. In another study, Amedu (2015) discovered that male students achieve more than female students in science subjects such as biology. In a related but a separate study, Adigun et al. (2015) found that gender has no significant influence on students' achievement in computer science. Furthermore, Glory and Ihenko (2015) revealed that there is no significant impact of gender on students' academic achievement in integrated science in high schools. However, in a related study, Umar and Samuel (2018) discovered that gender stereotyping has no significant influence on students' achievement in Basic Science. The foregoing points to the need for the use of mnemonics in teaching basic sciences while indicating the inconclusive nature of research findings on the topic. Thus, the study evaluates the impact of mnemonic instructional strategy on pupils' academic achievement in basic science.

Statement of the problem

The unswerving poor academic achievement of pupils in basic science is rapidly becoming a nightmare for educators and stakeholders. If this situation is left unabated, the scientific and technological development, as well as the economic growth of our great nation would be at stake. The main method of teaching basic science in primary schools is the talk and chalk. This method has been identified as a significant contributing factor to the depressing achievement in basic science among pupils. The talk-and-chalk method of teaching and learning process is regarded as teacher-centered approach, since it does not allow the learners to be active participants in the teaching-learning activity. Hence, the need to discover and apply an instructional strategy that is learner-centered. To this effect, therefore, this study investigated the impact of mnemonic instructional strategy on pupils' achievement in basic science in Enugu state, Nigeria.

Purpose of the study

The general purpose of the study was to investigate the impact of mnemonic instruction strategy on pupils' academic achievement in basic science. Specifically, the study determined if;

- Pupils taught basic science using mnemonic instructional strategy have better achievement scores than those taught using conventional approach.
- Male and female pupils have the same achievement mean scores in basic science.
- There is an interaction effect of strategy and gender on the mean achievement scores of pupils in basic science.

Research questions

The study was guided by the following research questions:

1. What are the mean achievement scores of pupils taught basic science using mnemonic instructional strategy and those taught using conventional strategy?
2. What are the mean achievement scores of male and female pupils in basic science?

Hypotheses

The following hypotheses were formulated for the study and tested at 0.05 level of significance:

H₀₁: There is no significant difference in the mean achievement scores of pupils taught basic science using mnemonic instructional strategy and those taught using conventional strategy.

H₀₂: There is no significant difference in the mean achievement scores of male and female pupils in basic science.

H₀₃: There is no significant interaction effect of strategy and gender on the mean achievement scores of pupils in basic science.

Methodology

The study adopted a quasi-experimental research design, utilizing the pre-test, post-test non-equivalent control group design. The population comprised all the primary 5 pupils in all the 1,223 public primary schools in Enugu State. A sample of 89 primary 5 pupils from two public primary schools selected through a simple random sampling procedure was used for the study. Two (2) intact classes were assigned to control and experimental groups, in each of the two (2) primary schools. This came to a total of 45 pupils in the control group and 44 pupils in the experimental group. These numbers were made up of 34 males and 55 females. The instrument used in the study is researchers' made instrument titled Basic Science Achievement Test (BSAT). The instrument was a 25-item multiple-choice test with items generated from Basic Science Curriculum for Primary Schools. The items were drawn using a table of specifications to ensure the content validity of the test. Three experts validated the instrument, one each from science education, childhood education, and educational psychology, their inputs were considered as the instrument was restructured. The reliability of the instrument was determined by administering the instrument to a group of 30 pupils outside the study sample through the test-retest method within two weeks. The data were analyzed using Pearson Product Moment Correlation Coefficient which gave a reliability coefficient of 0.87. The two groups were given a pre-test to determine cognitive experiences. Subsequently, their regular basic science teacher, who already was instructed on the use of mnemonic instructional strategy, taught the experimental groups. This strategy allowed the pupils to assimilate the concepts taught and allowed them to take active participation in the class activity producing their mnemonics to aid their memory. The control groups were taught the same concepts by their regular teacher using conventional method. The pupils accepted what the teacher taught without active participation in the classroom activities. This programme lasted for 4 weeks after which the pupils were given a post-test with a rearranged version of the pre-test. The data collected was analyzed using mean and

standard deviation to answer the research questions and ANCOVA statistical tools to test the null hypotheses at 0.05 level of significance.

Results

Research Question One: What are the mean achievement scores of pupils in Basic Science when taught using mnemonic instructional strategy and those taught using conventional strategy?

Table 1: Mean analysis of the achievement scores of experimental and control groups

Treatment	n	Pretest		Posttest		Mean gain
			Std. Deviation	Mean	Std. Deviation	
Experimental Group	45	8.48	1.40	18.80	4.29	10.32
Control Group	44	8.50	1.40	10.50	1.59	2.00

Table 1 showed that the pupils of the experimental group had mean achievement score of ($M = 8.48$, $SD = 1.40$) while the control group pupils had mean of ($M = 8.50$, $SD = 1.40$) at the pretest. On the other hand, the mean achievement score of the experimental group at the posttest is ($M = 18.80$, $SD = 4.29$) while that of the control group is ($M = 10.50$, $SD = 1.59$). The mean gain scores of 10.32 and 2.00 for the experimental and control groups respectively indicate that the pupils of the experimental group had higher posttest mean achievement score than the control group counterparts.

H₀₁: There is no significant difference in mean achievement scores of pupils in Basic Science when taught using mnemonic instructional strategy and those taught using conventional strategy.

Table 2: Analysis of covariance of the difference in the mean achievement scores of experimental and control groups

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1536.999 ^a	4	384.250	35.167	.000	.626
Intercept	423.635	1	423.635	38.772	.000	.316
Pretest	.171	1	.171	.016	.901	.000
Treatment	1398.543	1	1398.543	127.998	.000	.604
Gender	.145	1	.145	.013	.909	.000
Treatment * Gender	4.092	1	4.092	.374	.542	.004
Error	917.810	84	10.926			
Total	21678.000	89				
Corrected Total	2454.809	88				

a. R Squared = .268 (Adjusted R Squared = .236)

Table 2 revealed that there is a significant difference in the mean achievement scores of pupils taught Basic Science using mnemonic instructional strategy and those taught using the conventional lecture method of teaching in favour of the pupils exposed to mnemonic instructional strategy, $F(1, 84) = 127.998, p = .000$. Hence, the null hypothesis was rejected ($p < .05$). Besides, the effect size of 0.604 indicates that 60.4% change in the achievement of pupils in Basic Science is as a result of their exposure to mnemonic instructional strategy.

Research Question Two: What are the mean achievement scores of male and female pupils in Basic Science?

Table 3: Mean analysis of the achievement scores of male and female pupils in Basic Science

Gender	n	Pretest		Posttest		Mean gain
		Mean	Std. Deviation	Mean	Std. Deviation	
Male	39	9.06	1.27	14.75	5.46	5.69
Female	50	8.98	1.37	14.66	5.23	5.68

Table 3 showed that the mean achievement score of male pupils at the pretest is ($M = 9.06, SD = 1.27$) while that of the female pupils is ($M = 8.98, SD = 1.37$). However, male pupils had higher mean achievement score ($M = 14.75, SD = 5.46$) than female pupils ($M = 14.66, SD = 5.23$).

H₀₂: There is no significant difference in mean achievement scores of male and female pupils in Basic Science.

Table 2 showed that there is no significant difference in the mean achievement scores of male and female pupils in Basic Science, $F(1, 84) = 0.013, p = .909$. Hence, the null hypothesis was not rejected ($p > .05$).

H₀₃: There is no significant interaction effect of treatment and gender on pupils' achievement in Basic Science.

Table 2 showed that there is no significant interaction effect of treatments and gender on pupils' achievement in Basic Science, $F(1, 84) = .374, p = .005$. Thus, the null hypothesis was not rejected ($p > .05$).

Discussion of findings

The findings of the study revealed that Mnemonic instructional strategy is superior to traditional instructional strategy as indicated in Tables 1 and 2. Table 2 further revealed that there was a significant difference in the mean achievement scores of pupils exposed to mnemonic instructional strategy, and those exposed to conventional method of teaching basic science in favour of the pupils exposed to mnemonic instructional strategy. The finding of the study validated the findings of Adepoju (2014) who found out that students

who were taught chemistry using mnemonic instructional strategy achieved better than their counterparts who were taught using conventional method. The finding of the study is also in line with the finding of Okoro and Unamba (2020), who discovered that pupils taught mathematics using mnemonic instructional strategy performed better in mathematics than their counterparts taught mathematics utilizing conventional strategy.

The findings of the study indicated that even though male pupils performed better than female pupils in basic science, there is no significant difference in the mean achievement scores of male and female pupils in Basic Science. This implies that gender has no effect on the mean achievement scores of pupils in basic science. The findings of this study are in line with the discoveries of Umar and Samuel (2018) who discovered that gender stereotyping has no significant influence on students' achievement in Basic Science. However, the results of the study invalidated the findings of Amedu (2015) who found that male students achieve more than female students in science subjects such as biology.

Conclusion and recommendations

Based on the findings of the study, it is concluded that mnemonic instructional strategy aids pupils' achievement in Basic Science and so is superior to traditional instructional strategy. Again, the study concluded that gender is not a significant variable in pupils' achievement in basic science. It is therefore, recommended that mnemonic instructional strategy be developed and teachers trained on how to utilize it during instructions. Additionally, that gender bias should be discouraged in relation to the achievement of pupils in Basic Science in primary schools.

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