



Effective Delivery of Basic Science Curriculum Concepts Using Inquiry Based Strategy on Students' Academic Achievement in Delta Central Senatorial District

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ABSTRACT

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The study investigated the effective delivery of Basic Science curriculum concepts using inquiry based strategy on students' academic achievement in Delta Central Senatorial District. Three research questions and three null hypotheses guided the study. Quasi-experimental design was adopted for the study, specifically, non-equivalent pretest and posttest control group design. The sample for the study comprised of 275 JSS II basic science students from six mixed JSS2 classes in intact classes in Delta Central Senatorial District, drawn using Simple random sampling techniques. The experimental group was taught using inquiry based teaching strategy, while lecture method was taught using conventional. The instrument used for data collection was the Basic science Achievement Test (BSAT). Data collected were analyzed using mean, standard deviation and Analysis of Covariance (ANCOVA). The results revealed that inquiry based teaching strategy was superior to the conventional instructional method in facilitating students' achievement in basic science. There was no significant difference in the mean scores of male and female students in basic science curriculum concepts. Based on the findings, it was concluded that the inquiry based strategy is a better option in delivery Basic Science curriculum concepts. It was recommended among others that science teacher's educators should adopt inquiry based strategy when teaching in order to enhance students' achievement in basic science and technology.

KEYWORDS:

Inquiry, Curriculum, Basic Science and Technology, Achievement.

INTRODUCTION

Science is a systematic enterprise that builds and organizes knowledge in the form of explanations and predictions about the universe. The area of science education as a whole is concerned with transferring scientific knowledge to those who aren't often regarded as being a part of the scientific community. The discipline of scientific education includes instruction in technology and basic science, as well as some social sciences. (Berube, 2008). Basic science and technology was included as one of the core subjects in the school system. Basic science, technology, and

technology education's overarching goal is to empower students to observe and investigate their surroundings using both their hands and their senses. The following goals are specifically intended to help learners achieve them: cultivate an interest in science and technology, acquire fundamental knowledge and skills in science and technology, apply their knowledge and skills to address societal needs, take advantage of the many career opportunities provided by science and technology, and prepare for further studies in science and technology (Nigerian Educational Research and Development, NERDC 2017).

It has been observed that effective teaching through appropriate strategy may facilitate learning and make it more meaningful. In line with this Sander (2001) stated that effective teaching helps the learner to learn better, while poor teaching would naturally lead to poor learning and consequently poor achievement. The poor achievement in sciences as indicated by various empirical studies (Betiku, 2001; Ferdinand, 2007; Omole, 2003; NECO and WAEC Chief Examiner's reports, 2005,2007 respectively) have

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attracted the concern of all stakeholders. Numerous causes have now been discovered and are believed to be to blame for the downward trend in student performance. These factors include school-teacher-related characteristics, teaching methods social incentives, and a host of others (Oyovwi, 2022; Ogunkola, 2008). This suggests that if the afore listed factors and others can be taken into consideration, students will excel more in sciences generally and in Basic science and technology in particular. However, according to (Omole, 2003), the students' low performance in Basic science and technology is caused by instructors' employment of inappropriate teaching methods and strategies, which, among other things, have contributed to the students' poor performance in science at the junior secondary school.

Nigeria's basic science curriculum requires students to engage in inquiry and other activities that encourage critical thinking. This is clear from the fundamental science curriculum's aims, which include giving pupils the skills to;

- a. Develop interest in science and technology
- b. Acquire basic knowledge and skills in science and technology
- c. Use talents, technical knowledge, and abilities to satisfy society needs
- d. Develop the skills necessary to pursue a career in science or technology
- e. Prepare for more science and technology studies

The basic science curriculum is jam-packed with exercises and experiments designed to assist students better comprehend the theory while also providing on-going practice skill development (Oyovwi & Umukoro, 2022).

Olayiwola (2011) opined that over the years, Basic science and technology lesson delivery in Nigerian secondary schools has proved ineffective. The nature of learning and the wide range of students' abilities in the average classroom necessitate a high degree of teachers with experience in the method of presenting the subject matter. This will help the teacher to individualize the learning method as well as the content and working according to the student's need. This goal can be reached most effectively through the use of a better teaching method. Despite the importance of Basic science and technology, students consistently perform poorly in both internal and external examinations.

Inquiry is defined as an approach to teaching, the acts scientists use in doing science and it helps students to understand curriculum concepts and use of process skills (Yagger and Akcay, 2010). The phrase "inquiry teaching method" is also applied to a process of questioning, seeking knowledge, information, or learning about phenomena. This method entails looking into facts and drawing a conclusion (Sola and Ojo, 2007). Students learn concepts as well as self-direction, accountability, and social communication in an inquiry environment. Additionally, it enables students to take

in and integrate knowledge. When people are left alone, they learn in this manner. Oyovwi, (2021) stated that Inquiry strategy provides students the opportunity to find out facts and ascertain reasons why things are the way they are. The learner's puts things together, discovered facts, while the teacher acts as a catalyst. .

Achievement, in the words of Adeyemi (2008), is where a kid stands academically right now. It has to do with achieving the goal(s) at hand. The purpose of testing an achievement is to help the teacher and the students evaluate and estimate the degree of success attained in learning a given concept.

Gender is a socio-culturally ascribed attribute which differentiates feminine from masculine (Imoko, 2004). Gender is used to describe certain characteristics of men and women which are naturally, culturally and socially determined while those that are biologically determined are regarded as gender.

The importance of school as a citadel of learning in social environment is not an over statement (Denga, 2017). The type of school, its size, and how close or far away it is from other schools all play a role in how well the curriculum is delivered and how well children do. According to World Bank Guidelines (2014), school location refers to a school's site, kind of buildings, usage, capacity, teachers, students, environment, and other factors for rationalizing both rural and urban school maps.

STATEMENT OF THE PROBLEM

The achievement of students in Basic science and technology has continued to remain poor for years. The same trend of poor achievement of students in Basic science and technology was confirmed in the review of students' performance in the Junior Secondary Certificate Examination (JSSCE) from 2017-2020. In addition, general report on students' performance in Basic science and technology showed that candidates' performance was generally not impressive and, among other observations, students are unable to answer questions relating to Basic science and technology curriculum concepts. The reason behind the terrible Basic science and technological accomplishments may be attributed, among other things, to the delivery of the curriculum's inadequate instructional practices.

According to research, students studying basic science and technology do not have the same learning demands that other students do, and this is demonstrated by the standard lecture technique employed in Nigerian secondary schools. The teachers are more focused on fulfilling the need of the curriculum or covering the scheme of work for each term than ensuring that students learn effectively in order to achieve better. The lack of attention to the students' academic needs in the process of learning may have accounted for the continuous decline in students'

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achievement in Basic science and technology. Therefore, there is need for alternative teaching methods such as inquiry based strategy. This strategy not only takes into consideration the academic needs of students, but it equally ensures that male and female as well as urban and rural students learn at their own pace. Thus, the major problem which this study seeks to address is: Will inquiry based teaching strategies lead students to achieve better than the traditional lecture method?

Research Questions

The following research questions will guide the study.

1. What is the difference in the mean achievement scores in Basic science and technology between students' taught with inquiry based teaching strategy and lecture method?
2. What is the difference in the mean achievement scores between male and female Basic science and technology students taught with inquiry based teaching strategy?
3. What is the difference in the mean achievement scores between urban and rural Basic science and technology students taught with inquiry based teaching strategy?

Hypotheses

The following hypotheses will be tested at the 0.05 level of significance

1. There is no significant difference in the mean achievement scores in Basic science and technology between students' taught with inquiry based teaching strategy and lecture method.
2. There is no significant difference in the mean achievement scores between male and female Basic science and technology students taught with inquiry based teaching strategy.
3. There is no significant difference in the mean achievement scores between urban and rural Basic science and technology students taught with inquiry based teaching strategy.

Purpose of the Study

Finding out how an inquiry-based teaching method would support the efficient delivery of the basic science and technology curriculum is the overarching goal of this study. Specifically, the study will investigate the:

- i. Difference in the mean achievement scores in Basic science and technology between students taught with inquiry based and lecture method.
- ii. Difference in the mean achievement scores between male and female Basic science and technology students taught with inquiry-based teaching strategy.
- iii. Difference in the mean achievement scores between urban and rural Basic science and technology students taught with inquiry-based teaching strategy.

THEORETICAL FRAMEWORK OF THE STUDY

This research work was anchored on the theory of John Dewey on cognitive development. A philosopher, psychologist, and educational reformer, John Dewey (1938) made contributions to and had an impact on social and educational changes, particularly in areas like inquiry teaching and learning, among others (Wikipedia, 2011). According to Dewey, knowledge only appears when learners are forced to draw themselves out of significant learning circumstances. Theories of cognition go beyond action to describe how the brain learns. Cognitivists take into account how the human memory facilitates learning. According to Dewey, learning and education are social, interactive processes, and schools, as social institutions, offer a setting in which social reforms can and should happen. According to him, the classroom serves as a social setting where students can interact with resources and develop a community of learners who build knowledge together. All students should have the chance to participate in their own learning, according to Dewey. Dewey promoted experiential learning and asserted that information cannot be acquired without the use of mind-impressing objects. According to Dewey's constructivist philosophy, teachers and instructors are co-participants in the learning process whose support and advice enable students to build their own understanding of the material and independently find its meaning (Wikipedia, 2011). The obvious implication of Dewey's theory in this study is that in the learning process, students must be engaged in meaningful activities that induces them to apply the concepts they are trying to learn. The teacher's role should be to provide enabling environment for active learning to take place such an environment could be the guided inquiry approach

RESEARCH METHODOLOGY

This study employs the quasi-experimental non-randomized pre-test post-test control group design. There was no randomization of subjects in this study. Intact classes were randomly assigned to the experimental and control groups. All junior secondary students in Delta Central Senatorial District's public urban and rural schools made up the study's population. Junior Secondary Two (JS11) Basic science and technology pupils in the Delta Central Senatorial District, which has an estimated population of 18,926 people, made up the study population specifically. 275 Basic science and technology students from four J.SS 2 classrooms in the Delta Central Senatorial District served as the study's sample size. The study's four (4) intact classes

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were divided into the two groups at random. Simple random sample without replacement was used to allocate intact classes to each of the groups.

PRESENTATION OF RESULTS

Research Question One: What is the difference in the mean achievement scores in Basic science and technology between students' taught with inquiry based and lecture method?

Table 1: Mean and Standard Deviation of Pretest and Posttest Achievement Scores between Students Taught Basic Using Inquiry based and Lecture Method

Group	N	Pretest Mean	SD	Posttest Mean	SD	Mean Difference
Inquiry Based teaching	157	22.48	4.76	64.66	7.19	42.18
Lecture Method	118	22.10	6.34	56.22	7.94	34.12
Total	275					

The data in Table 1 shows a pretest mean achievement scores of 22.48 and 22.10 and standard deviation of 4.76 and 6.34, for students in inquiry based and lecture method groups. A higher posttest mean achievement scores of 64.66 and 56.22, and standard deviation of 7.19 and 7.94, respectively for students in the inquiry based and lecture method groups. The observed increment of 42.18 and 34.12, for students in the inquiry based and lecture method groups is

not due to chance rather as a result of treatment. This implies that the instructional strategy (inquiry based) have effect on students' achievement in Basic science and technology.

Hypothesis One: There is no significant difference in the mean achievement scores in Basic science and technology between students' taught with inquiry based and lecture method.

Table 2: T-test Comparison of Pretest and Posttest Mean Achievement Scores of Students Taught Basic science and technology using Inquiry Based and Lecture Method

Group	N	Pre-test Mean	SD	Posttest Mean	SD	Df	t-cal	sig. (2-tailed)	Remark
Inquiry Based	157	22.48	4.76	64.66	7.19	155	46.68	0.00	Ho₁ is rejected
Lecture	118	22.10	6.34	56.22	7.94	116	34.30	0.00	
Total	275								

P<0.05

Table 2 indicates a significant effect of inquiry based (t = 46.68, P(0.00) < 0.05), and lecture method (t = 34.30, P(0.00) < 0.05) on achievement. Therefore, Ho₁ was rejected. Thus, there is a significant difference in the mean achievement scores in Basic science and technology between students'

taught with inquiry based and lecture method in favor of students taught using inquiry based.

Research Question Two: What is the difference in the mean achievement scores between male and female Basic science and technology students taught with inquiry based teaching strategy?

Table 3: Mean and Standard Deviation of Posttest Achievement Scores of Male and Female Students Taught Basic science and technology Using Inquiry Based Teaching Strategy

Gender	N	Posttest Mean	SD	Mean Difference
Male	88	68.50	9.88	2.55
Female	69	65.95	9.02	
Total	157			

In table 3, the male students posttest mean achievement score is 68.50, with a standard deviation of 9.88, and the female students had a posttest mean achievement score of 65.95, with a standard deviation of 9.02. The overall mean difference between the gender is 2.55, in favor of male

students. This showed that the male students scored higher than their female counterparts in the basic science and technology achievement scores when taught using the inquiry teaching strategy.

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Hypothesis Two: There is no significant difference in the mean achievement scores between male and female Basic

science and technology students taught with inquiry based teaching strategy

Table 4: t-test Comparison of Posttest Mean Achievement Scores of Male and Female Students Taught Basic science and technology using Inquiry Based Teaching Strategy

Gender	N	\bar{x}	SD	DF	t-cal.	Sig. (2-tailed)	Decision
Male	88	68.50	9.88	155	1.319	0.190	Not Significant
Female	69	65.95	9.02				
Total	157						

P>0.05

The data in Table 4 shows that there is no significant difference between the mean achievement scores of male and female students taught basic science and technology using inquiry-based teaching strategy, $t = 1.319$, $P(0.190) > 0.05$. Thus, the null hypothesis was retained. This implies that there is no significant difference between the mean achievement scores of male and female students taught basic science and

technology using inquiry-based teaching strategy. The treatment using inquiry-based teaching strategy is not gender biased.

Research Question Four: What is the difference in the mean achievement scores between urban and rural Basic science and technology students taught with inquiry based teaching strategy?

Table 5: Mean and Standard Deviation of Posttest achievement Scores of Urban and Rural Students Taught Basic science and technology Using Inquiry Based Strategy

Location	N	Posttest Mean	Mean Difference	SD
Urban	89	55.57	5.08	11.05
Rural	68	60.65		11.87
Total	157			

In table 5, the urban students posttest mean achievement score is 55.57, with a standard deviation of 11.05, the rural students had a posttest mean achievement score of 60.65, with a standard deviation of 11.87. The overall mean difference between locations is 5.08, in favor of rural students. This showed that the rural students scored higher

than their urban counterparts in the basic science and technology when taught with inquiry based teaching strategy.

Hypothesis Four: There is no significant difference in the mean achievement scores between urban and rural Basic science and technology students taught with inquiry based strategy.

Table 6: t-test Comparison of Posttest Mean achievement Scores of urban and rural Students Taught Basic science and technology Using Inquiry Based strategy

Location	N	\bar{x}	SD	DF	t-cal.	Sig. (2-tailed)	Decision
Urban	89	55.57	11.05	155	2.196	0.030	Significant
Rural	68	60.65	11.87				
Total	157						

P<0.05

The data in Table 6 shows that there is a significant difference between the mean achievement scores of urban and rural students taught basic science and technology using inquiry-based strategy, $t = 2.196$, $P(0.030) < 0.05$. Thus, the null hypothesis is rejected. This implies that there is a significant difference between the mean achievement scores of urban and rural students taught basic science and technology using inquiry-based teaching strategy, in favor of

rural students. The treatment using inquiry-based strategy is location biased.

DISCUSSION

Difference in the mean achievement scores in Basic science and technology between students' taught with inquiry based and lecture method

According to the study, there is a substantial difference between students who were taught using an

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inquiry-based approach and those who were taught using a lecture technique in terms of their mean achievement scores in basic science and technology, favoring the inquiry-based strategy, which was found to be more successful than the lecture. The experimental group's therapy may have improved students' understanding of basic scientific and technology concepts more than the control group, as evidenced by the difference in the mean achievement scores between the two groups. This shows that the better achievement ratings may have been a result of the students in inquiry-based groups participating more actively in the teaching and learning process. The low achievement scores of students in the lecture group is as a result of the passive involvement of students during the teaching and learning process since teachers pass their knowledge to students. This finding supports Ibe (2004) and Oyovwi (2021) who indicated that inquiry approaches proved to enhance student's achievement in sciences more than the traditional instructional methods like lecture and demonstration.

Difference in the mean achievement scores between male and female Basic science and technology students taught with inquiry-based strategy

The study's results revealed that there was no discernible difference between male and female students who were taught fundamental science and technology utilizing an inquiry-based approach in terms of their mean achievement scores. Since the technique guaranteed students' active involvement during the teaching and learning process regardless of students' gender, the implication is that both male and female performed similarly. This result is consistent with that of Ibe and Nwosu (2003) and Oyovwi (2022), who discovered that gender had no discernible influence on students' academic performance. This study concurs with that of Farahani and Nejad (2008), who found that task-based learning does not take gender into account when determining speaking growth. However, this findings disagree with the work of Bichi (2002), who opined that there is gender difference in subject choice and in academic performance within the subjects and that School subjects are gender – stereotyped such as mathematics, physical sciences, computing and engineering which are regarded as masculine subjects while humanities, languages, domestic subjects are regarded as feminine.

Difference in the mean achievement scores between urban and rural Basic science and technology students taught with inquiry-based strategy

The study found a substantial difference between urban and rural pupils who were taught basic science and technology using an inquiry-based approach, favoring the rural students. Location bias exists in the inquiry-based treatment. According to Alokani's (2013) research, pupils from rural areas outperformed their urban counterparts in

verbal ability and English language. This result is consistent with that research.

In another development, this finding disagrees with the work of Graham and Lauren (2013), Ayula et al (2017) and Alokani (2013) who have shown significant difference in achievements between rural and urban located schools in favor of urban schools. Their findings were borne out of the fact that urban schools have facilities for experimentation purposes unlike most rural schools.

CONCLUSION

Inquiry-based strategy facilitates the delivery of basic science curriculum and also augments students' achievement than the lecture method. Inquiry-based teaching did not differentiate between gender with respect to students' achievement in Basic science and technology.

RECOMMENDATION

1. The adoption of inquiry-based teaching strategy by basic science and technology teachers during classroom instruction at the secondary school level to ensure students active involvement.
2. Irrespective of school location, government should provide adequate infrastructural facilities and instructional materials to ensure effective implementation of innovative instructional strategies during instruction at the secondary school level.
3. Basic science and technology teachers should attend workshops to get acquainted with innovative instructional strategies.

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