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EFFECT OF INTEGRATED INQUIRY-BASED SCIENCE TEACHER PRACTICE ON BASIC EDUCATION STUDENTS' ACADEMIC PERFORMANCE IN TARABA STATE, NIGERIA

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ABSTRACT

This study examined the effect of Integrated Inquiry-Based Science Teacher Practice on Basic Education Students' Performance in Basic Science in Jalingo Education Zone, Taraba State Nigeria. Two specific objectives with corresponding research questions and hypotheses guided the study. The study adopted a quasi-experimental research design of pretest, posttest non-equivalent groups. Out of 4,141population size, 292 was sampled out for the study. Data for was generated using Basic science Performance Test (BSPT). Kuder-Richardson (K-R20) formular was used to determine the reliability index of 0.85 for the BSPT. Mean and standard deviation were used to answer all research questions. While analysis of covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The result showed significant difference in the mean performance score in favour of students taught Basic Science using integrated-inquiry-based science teacher practice and those taught using guided inquiry instructional strategyand promotes equal performance between male and female students. It was recommended among others that Basic Science Teachers should be encouraged to use integrated inquiry-based science teacher practice Instructional strategy.

Keywords: Integrated Inquiry-based Science, Teacher, Practices, Students, and Academic Performance.

INTRODUCTION

The effect of pedagogy on basic education students' academic performance in any country cannot be over emphasized. Science is the pursuit and application of knowledge and understanding of the natural and social world following a systematic methodology based on evidence; it is the observation, identification, description, experimental investigation and theoretical explanation of natural phenomenon. Science is a systematic investigation of nature with a view to understanding and harnessing them to serve human needs Okoro (2013). The importance of science has led scientist to strategizing on how to develop science and technology to earn national and international recognition. The world is becoming a global village with every nation struggling to control it through scientific investigation with capacity to attract global acceptances. The scientific development of a nation is dependent on the level of scientific knowledge of her citizenry Abungwa, et al. (2014). Therefore, science being the foundation for sustainable development is undeniably and unquestionably a key to national economic growth and prosperity. In the current information and technology

age, when scientific information increases day by day, technological innovations advance rapidly, it is clearly seen that education in science plays a key role for the future of the society because the effects of science are seen overtly in every aspect of our lives. This could be one of the reasons science concepts is taught at the Primary School in the form of Basic Science.

Basic science is the science subject designed to expose learners to scientific and technological knowledge and skills that will assist them to make informed decisions, develop strategies and learn to contribute meaningfully in the contemporary society (Ellah & Achor, 2017). This implies that acquisition of adequate knowledge in the subject could equip the learner with what it takes to become useful to the society and also to be prepared for further studies in science thus fulfilling, the National goals of Education in Nigeria (NPN, 2014). On the same note, Ayodele (2016) submitted that Basic Science is the bedrock of future understanding of advanced studies in Science, Technology, Engineering and mathematics (STEM). This shows that the concept if well-captured could prepare the learner for further studies in science at the secondary school level of Education as insinuated by Oludipe (2012). This submission implies that the subject is the foundation of science education in Nigeria

The subject introduces learners to the basic rudiments of science at primary Education level. The National Policy on Education defines Basic Science as the aspect of education which leads to acquisition of practical and applied basic scientific knowledge. The main reason for teaching Basic Science is to widen the knowledge of students in science which enables them to appreciate the unity among science subjects and apply what they have learnt to real life situation (Nwafor, 2016). This submission by Nwafor indicates the need for learners to excel in basic science.

Despite this importance of basic science to life, students perform poorly in Basic Science as documented in the Education Resource centre of Taraba State Ministry of Basic and Secondary Education report of basic education certificate examination (BECE) results for Basic Science and Technology (BST) from 2013-2022. Statistics of results revealed poor performance by students in Basic Science. From the analysis, it is clear that there is a trend of poor performance in basic science examination. There is no appreciable improvement in academic performance of students in Basic Science in BECE between the years 2013 – 2022.

The performance of students is below average and therefore calls for serious attention. The low academic performance could be as a result of the teaching strategy adopted by Basic Science teachers which probably failed in enabling the students to apply what they have been taught to real life situation, hence unable to appreciate the unity among science subjects because it was probably taught without adequate teacher feedback.

Feedback is defined as a process by which teachers and students provide response during instruction to organize the learning and teaching process in order to increase students' performance. Feedback could be viewed as a valid and vital part of blending teaching and assessment. There are four main components of feedback as a process of formative assessment. These are, explaining learning objectives and success criteria, increasing the quality of marking/feedback/record keeping, using self and peer assessment and increasing the quality of inquiry/dialogue (William, 2011). For the

components of teacher feedback stated above to be realized, effective inquiry is needed during classroom interaction.

Inquiry as submitted by Danjuma (2015) is an approach to learning that involves a process of exploring the natural or material world, and that leads to asking questions, making discoveries, and testing those discoveries in the search for new understanding. The term inquiry is used to invoke the idea of teaching science in the way it is actually practiced by scientists, that is, problem-solving through formulating and testing hypothesis Teachers use varieties of assessment activities and strategies in problem-solving to gain comprehensive insight into how much students learn via feedback integrated-inquiry-based as an instructional strategy in science practice.

In contrast, the traditional classroom often looks like a one-person show with a largely uninvolved learner. Traditional classes are usually dominated by direct and unilateral instruction. Traditional approach followers assume that there is a fixed body of knowledge that the student must come to know. Students are expected to blindly accept the information they are given without questioning the instructor (Ali, 2014). The author submitted that the teacher seeks to transfer thoughts and meanings to the passive student leaving little room for student-initiated questions, independent thought or interaction between students. Even in the activity-based subjects like Basic Science, although activities are done in groups but do not encourage discussion or exploration of the concepts involved.

Academic performance is defined as a measurable, observable and specific statement that clearly indicates what a student should know and be able to do as a result of learning experience. It consists of individual scores at any particular time obtained from either a teacher-made test or a standardized test. According to Spady (2016) academic performance are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a programme. Spady notes that academic performance identifies what the learner will know and be able to do by the end of a programme. In Nigeria, at least a credit pass in Basic Science is the minimum requirement for getting admission into secondary school to study Science. However, this trend of poor students' performance in Basic Science has aborted the ambition of many students' studying science discipline programmes such as medicine, space science engineering, (ICT) among others.

In reference to gender, Nworgu, et. al (2019) opined that gender is a dimension of social organization which shapes how people interact with others and how people behave or act and think about themselves. Gender is the societal meaning assigned to male and female with a particular role that each should play. This is verifiable in relation to belief, interest and academic performance of students in this study because there is a general belief among Nigerians that male are superior to female in terms of physical, cognition, logical reasoning and performance (Ellah, 2014). Furthermore, Garba (2019) found that gender has impact on science education, but there are mix results on the performance of male and female in science. For instance, Egbo (2015) found that female students performed better than male students in the science subjects. On the other hand, Liga and Emaikwu (2015) found no significant difference in science performance between male and female students. The present study therefore is pivoted on research

studies on the applicability of feedback integrated-inquiry-based instructional delivery on students' performance in learning basic science concepts.

Purpose of the Study

The purpose of this study was to investigate the effect of integrated inquiry-based science teacher's practice on students' academic performance in Basic Science in Taraba State, Nigeria.

Specifically, the study sought to:

1. Find out the effect of integrated-inquiry-based science practice instructional strategy and guided inquiry instructional strategy on students' Academic Performance in Basic Science.
2. Ascertain the effect of integrated-inquiry-based science teacher and guided inquiry instructional strategy practice on male and female students' Academic Performance in Basic Science.

Research Questions

The study was guided by the following research questions:

1. What is the effect of integrated-inquiry-based science practice instructional strategy and guided inquiry instructional strategy on students' Academic Performance in Basic Science?
2. What is the effect of integrated-inquiry-based science teacher and guided inquiry instructional strategy practice on male and female students' Academic Performance in Basic Science?

Hypotheses

The following hypotheses were formulated to be tested at 0.05 level of significance

1. There is no significant difference in the mean academic performance score of students taught Basic Science using integrated-inquiry-based science teacher practice and those taught using guided inquiry instructional strategy.
2. There is no significant difference in the mean academic performance of male and female students taught Basic Science using integrated-inquiry-based science teacher practice and those taught using guided inquiry instructional strategy.

METHODOLOGY

Quasi-experimental pretest posttest, non- equivalent groups was used for the study**.**The study was conducted in Jalingo Education Zone of Taraba State, Nigeria. The population of the study consisted of 4,141 upper basic II Students from the 50 Public Schools in Jalingo education zone of Taraba State 2023/2024 academic session, The population of Upper Basic II Students which will consist of 2,338 males and 1,803 females' students**.** The sample of the study comprised of 292 Upper Basic Education Two students from Jalingo Education Zone. Which was made up of 139 male students and 153 female students randomly drawn from 6 intact classes which constituted the sample for the study? The multi-stage random sampling techniques were used in constituting the sample for the study. The instrument used for the study was adapted and organized

by the researcher. The instrument that was use for the study to collect data was Basic Science Performance Test (BSPT). In order to determine the internal reliability of the instruments, 40 copies of the instruments were pilot tested at Bali Education Zone of Taraba state which was not part of the schools for the main study. The reliability index obtained was 0.85 for BSPT using K-R formula 20. The index above reveals that the instrument was highly reliable for the study. Mean and Standard Deviation was employed to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significance.

RESULTS

Research Question One.

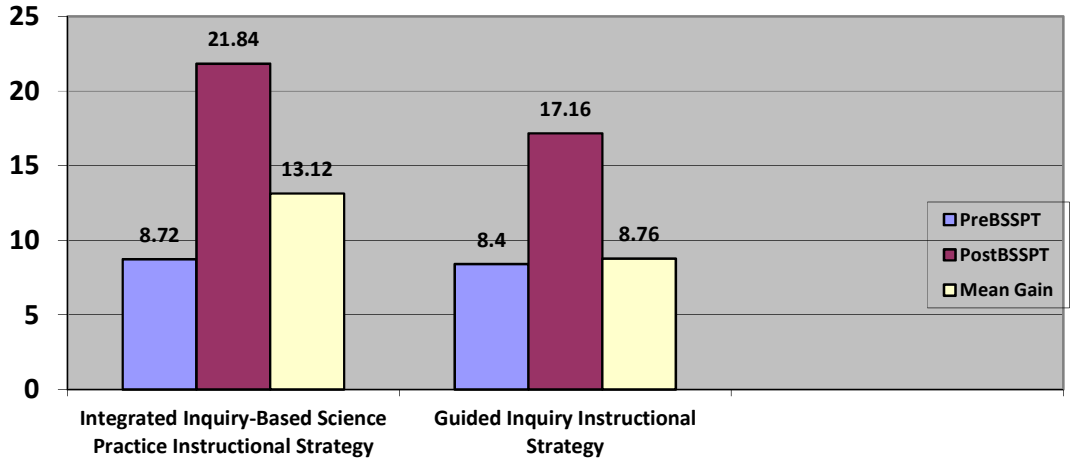
What is the mean performance score of students taught basic science using integrated inquiry-based science practice what is the mean belief rating of students taught basic science using integrated inquiry-based science practice and those taught using guided inquiry instructional strategies? Data answering this question are contained in Table 1.

Table 1: Mean Performance Score of Students taught Basic Science using Integrated Inquiry-Based Science Practice and Guided Inquiry Instructional Strategies

Strategies		Pre BSPT	Post BSPT	Mean Gain
Integrated Inquiry-Based Science Practice	Mean	8.72	21.84	13.12
	N	138	138	
	Std. Deviation	3.88	5.61	
Traditional instructional strategy	Mean	8.40	17.16	8.76
	N	154	154	
	Std. Deviation	3.90	7.25	
Mean difference				4.36

Figure 1: Pretest, Posttest Mean Gain in Performance Score of Students taught Basic Science using Integrated Inquiry-Based Science Practice and Guided Inquiry Instructional Strategies.

Table 1 mean performance score of students taught basic science table



shows that 138 students were taught basic science using integrated inquiry-based science practice instructional strategy and 154 students were taught basic science using traditional instructional strategy. The table reveals that the mean performance score of students taught basic science using integrated inquiry-based science practice instructional strategy is 8.72 with a standard deviation of 3.88 during pre-test and 21.84 with a standard deviation of 5.61 in post test while the mean performance score of students taught basic science using traditional instructional strategy is 8.40 with a standard deviation of 3.90 during pre-test and 17.16 with a standard deviation of 7.25 in post test. The table further shows that the mean gain for integrated inquiry-based science practice instructional strategy is 13.12 and traditional instructional strategy is 8.76. The difference in the mean performance score of students taught basic science using integrated inquiry-based science practice instructional strategy 4.36 in favour of students in integrated inquiry-based science practice class. The summary of the pretest, posttest mean performance score as well as the mean gain in the performance score of students in the strategies is as shown in Figure 1.

Research Question Two.

What is the mean performance score of male and female students taught basic science using integrated inquiry-based science practice? Data answering this question are contained in Table 2.

Table 2: Mean Performance Score of Male and Female Students taught Basic Science using Integrated Inquiry-Based Science Practice

Gender		Pre BSPT	Post BSPT	Mean Gain
Male	Mean	9.01	22.29	13.28
	N	65	65	
	Std. Deviation	3.66	5.73	
Female	Mean	9.04	21.68	12.64

	N	73	73
	Std. Deviation	3.73	5.49
Mean difference			0.64

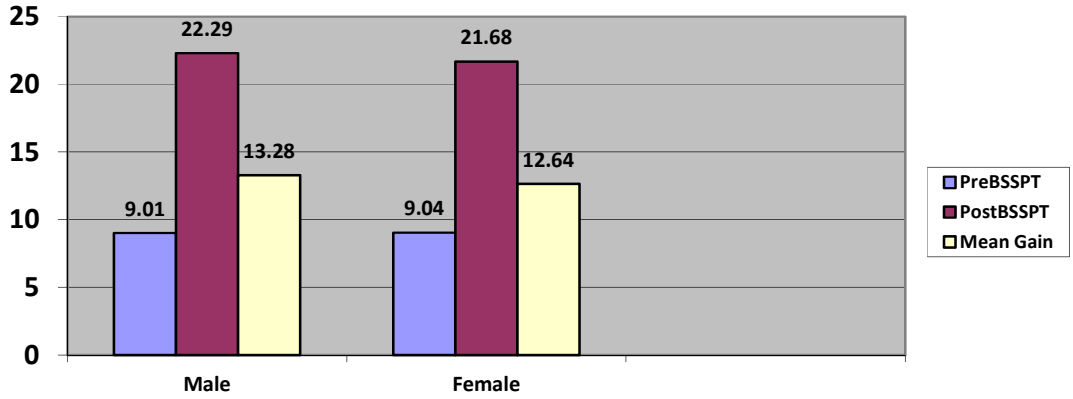


Figure 2: Pretest, Posttest Mean Gain in Performance Score of Male and Female Students taught Basic Science using Integrated Inquiry-Based Science Practice.

Table 2 shows the mean performance score of male and female students taught basic science using integrated inquiry-based science practice. The table shows that 65 male students and 73 female students were taught basic science using integrated inquiry-based science practice instructional strategy. The table reveals that the mean performance score of male students taught basic science using integrated inquiry-based science practice is 9.01 with a standard deviation of 3.66 during pre-test and 22.29 with a standard deviation of 5.73 in posttest while the mean performance score of female students taught basic science using integrated inquiry-based science practice is 9.04 with a standard deviation of 3.73 during pre-test and 21.68 with a standard deviation of 5.49 in posttest. The table further shows that the mean gain for male students is 13.28 and females' student is 12.64. The difference in the mean performance score of male and female students taught basic science using integrated inquiry-based science practice 0.64 which is not very significant, indicating that the integrated inquiry-based science practice is gender friendly. The summary of the pretest, posttest mean performance score as well as the mean gain in the performance score of male and female students is as shown in Figure 2.

Hypothesis One

There is no significant difference in the mean academic performance score of students taught Basic Science using integrated-inquiry-based science teacher practice and those taught using traditional instructional strategy. Data testing this hypothesis are contained in Table 3.

Table 3: ANCOVA of Performance of Students taught Basic Science using Integrated-Inquiry-Based Science Practice and traditional Instructional Strategy
Dependent Variable: postBSPT

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1776.946[a]	2	888.473	21.081	.000	.127
Intercept	15691.284	1	15691.284	372.318	.000	.563
Performance	183.556	1	183.556	4.355	.038	.015
Strategies	1546.257	1	1546.257	36.689	.000	.113
Error	12179.859	289	42.145			
Total	123629.000	292				
Corrected Total	13956.805	291				

a. R Squared = .127 (Adjusted R Squared = .121)

Table 3 reveals that F(1,289) = 36.689; p = 0.000 < 0.05. Thus, the null hypothesis is rejected. This implies that there is significant difference in the mean academic performance score of students taught Basic Science using integrated-inquiry-based science teacher practice and those taught using guided inquiry instructional strategy. Thus, there is significant difference in the effect of integrated-inquiry-based science teacher practice and traditional instructional strategy on mean academic performance score of students in Basic Science. The partial Eta square of 0.113 obtain for strategies means that only 11.3 percent of students' mean academic performance in Basic Science can be attributed to the strategies employed.

Hypothesis Two

There is no significant difference in the mean academic performance of male and female students taught Basic Science using integrated-inquiry-based science teacher practice and those taught using traditional instructional strategy. Data testing this hypothesis are contained in Table 4.

Table 4: ANCOVA of Performance of Male and Female Students taught Basic Science using Integrated-Inquiry-Based Science Practice
Dependent Variable: postBSPT

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	130.327[a]	2	65.163	2.119	.124	.032
Intercept	7260.363	1	7260.363	236.062	.000	.647
preBSPT	118.308	1	118.308	3.847	.052	.029
Gender	12.294	1	12.294	.400	.528	.003
Error	3967.552	135	30.756			
Total	67810.000	138				
Corrected Total	4097.879	137				

a. R Squared = .032 (Adjusted R Squared = .017)

Table 4 reveals that $F(1,135) = 0.400$; $p = 0.528 > 0.05$. Thus, the null hypothesis is not rejected. This implies that there is no significant difference in the mean academic performance of male and female students taught Basic Science using integrated-inquiry-based science teachers practice implying that the pedagogy is gender friendly. Therefore, there is no significant difference in the effect of integrated-inquiry-based science teacher practice on mean academic performance scores of male and female students in Basic Science. The partial Eta square of 0.003 obtain for gender means that only 0.3 percent of students' academic performance in Basic Science can be attributed to gender.

DISCUSSION

Findings of this research revealed that the mean performance score of students taught basic science using integrated inquiry-based science practice instructional strategy was higher than those taught using traditional instructional strategy. There was significant difference in the mean performance score of students taught Basic Science using integrated-inquiry-based science teacher practice and those taught using traditional instructional strategy. The finding agrees with the opinion of Igoh and Danjuma (2021) where the authours submitted that students under rubric self-assessment tool scored higher than those taught using a traditional instructional strategy. The finding also agrees with Danjuma et.al (2021) who found out that students taught basic science using assignment feedback perform and retained knowledge higher than those taught without assignment feedback indicating that assignment feedback improves student, performance in basic science. This implies that students that were able to have access to teachers' correction of their class work, assignment or other forms of formative assessment tools have the tendency of improving their performance more than those who does not have access to their formative assessment work as is normal in traditional instructional strategy. The result of this research also shows that student students were able to find answers to questions and other problems that they encounter during the learning process. This assertion agrees with the work of Ali (2024) where he stated that inquiry enable students to solve problems they encounter during the learning process.

The result obtained revealed that the mean academic performance of male students taught basic science using integrated inquiry-based science practice and female student taught basic science using integrated inquiry-based science practice did not differ significantly. There was no significant difference in the mean academic performance of male and female students taught Basic Science using integrated-inquiry-based science teacher's practice. This implies that the use of integrated-inquiry-based science teacher practice is gender friendly with reference to the mean performance scores of male and female students in Basic Science. The finding disagrees with Bajon and Danjuma (2021) that there was significance difference in the achievement between gender of students in the mean gain achievement scores of students taught using laboratory teaching strategy and their counterpart taught using traditional teaching strategy. However, the findings of Achor et.al (2013) is in agreement with the result of this study in that, the authours found out that females perform in similar manner as males when innovative strategies are utilized for teaching and learning. The finding

also agrees with Yakubu (2016) that there was no significant difference in performance between male and female students in the experimental group which implies the teaching strategy is gender-friendly.

The findings of this study revealed that integrated inquiry-based science teacher practice is gender friendly and can improved basic education students' academic performance in basic science better than the traditional instructional strategy in Taraba State Nigeria.

CONCLUSION

The strategy enhanced students' academic performance in Basic science and the effect of this instructional strategy is not dependent on gender.

RECOMMENDATIONS

Basic Science Teachers should be encouraged to use integrated inquiry-based science teacher practice Instructional strategy.

Pre-service teachers should be trained on the use of this instructional strategy. 3. Curriculum planners and science teachers should be incorporate innovative, problem solving and activity based pedagogical strategies like inquiry based instructional strategy in all teacher education instructions.

Professional bodies should organize seminars, workshops and symposia on the use of inquiry based instructional strategy for science teachers.

REFERENCES

Abungwu, E. O. Okene, I.O. & Wachanga, W.S. (2014). Effects of science process skills teaching strategy on boys and girls' achievement in chemistry in Nyando district, Kenya. *Journal of Education and Practices, 5(15), 42-50.*

Achor, E. E., Musa, H. W,. & Duguryil, Z. P. (2013). Do cooperative learning strategies have the potentials to eliminate gender difference in students' achievement in biology? The effect of STAD andJigsaw cooperative strategies. *Journal of science, technology, mathematics and education (JOSTMED, 10 (1), (21-24)*

Ali, A. (2014). The effect of inquiry-based learning method on students' academic achievement in science course. *Universal journal of educational research, 2(1), 37-41.*

Ayodele, M. O. (2016). Interest, self-concept and achievement of Junior Secondary School students in Basic Science in Ekiti State, Nigeria.*Journal of Educational and Social Research (MCSER Publishing, Rome-Italy),* 6(1)167 – 172

Bajon, R.H. & Danjuma G. S. (2021). Effects of laboratory teaching strategy on secondary school students of biology achievement in Taraba state, Nigeria. *Journal of science, technology, mathematics and entrepreneurial education (JSTMEE) I (2)*

Danjuma, G.S, (2015). Effects of collaborative and competitive learning strategies on upper basic II students' interest and achievement in basic science. Unpublished Ph.D. thesis, University of Nigeria Nsukka

Danjuma, G.S Michael, A. & Ndong P. (2021) journal of science technology mathematic and entrepreneurial education (JSTMEE). Vol.1 NO.4 (special issues)

Ellah, B. O &Achor, E. E. (2017). Achievement in Basic Science and Technology as correlates of student's performance in science in senior secondary schools in Nigeria. *Journal of the International Centre for Science, Humanity and Education Research.* 3(2), 73-83.

Garba, F.N. (2019). *Comparative effects of experiential, inquiry and expository strategies on students' achievement and interest in Social Studies in education Zone B, Benue State.*An unpublished PhD thesis, Benue State University Makurdi, Benue State.

Nwafor, C. E. (2016). Effects of computer assisted instruction on junior secondary school students' achievement in Basic Science. *International Journal of Scientific & Engineering Research*, 7(10), 1941-1957.

Oludipe, O.I. (2012). Gender differences in Nigerian junior secondary students' academic achievement in Basic Science. *Journal of Educational and Social Research, 2(1),* 93 – 99.

Okoro, A. U. (2013). Effects of investigative approach and expository methods on acquisition of science process skill in biology students of different levels of science literacy. *Journal of Science Teachers' Association of Nigeria*, 41(172), 79-88.

Yakubu, K.O (2016), Effect of field-based teaching strategy on interest retention and performance in climate change among secondary school students in Anchau Jaduna Nigeria. Unpublished thesis, Ahmadu bello university, Zaria