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Bridging the Gap Among Students with Different Ability Learning Outcomes Using Guided Enquiry Problem Solving Approaches Among Unity Colleges North Central Nigeria

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***Abstract*: The study determined in bridging the gap among students with different ability learning outcomes using guided inquiry and problem-solving approaches among unity colleges, north central Nigeria. The study adopted two experimental groups and one control group of 2x2x3 factorial research design. Sample consists 373 (male = 198 and female 175) JSS 111 students. Basic science and Technology Students Achievement Test (BSTSRT) was used for data collection while guided inquiry, Problem solving and Traditional approaches were used as treatment instrument. Pearson Product Movement Correlation (PPMC) was used to determine the reliability coefficient of BSTSRT. The reliability coefficient of 0.86 was obtained Data were analyzed using Analysis of Variance (ANOVA). The ANCOVA) and Sidak Post-Hoc Multiple Comparison (SPMC). Results revealed that, significant differences were established in the post-test mean scores of GI, PSA and Traditional method. There was a significant difference in the retention score in Basic science and technology achievement between the three groups, F (2, 369) = 84.071, p = (0.00 <0.05). Indicates a significant difference between the mean of the guided inquiry, problem-solving and traditional method group retention in Basic Science and Technology. The treatment favouring GI and PSA. Also A significant difference exists between problem-solving high achievers and Medium and low achievers of Guided inquiry, medium and low achievers of Problem solving and high, medium and low achievers of the traditional group based on these findings, the following recommended were made: that Guided inquiry and Problem solving should be incorporated into the teaching method adopted to Basic science and Technology since they have the capability to enhance the students' academic achievement and retention. Basic science and Technology teachers be encouraged to use guided inquiry and problem-solving instructions to provide equal opportunity to students of different ability.**

***Keywords*: ability levels, achievement, guided inquiry, problem solving, retention.**

1. Introduction

Nigeria is looking forward to being among the world's most scientific and technologically advanced nations. The reason is not far-fetched from what (Enemarie 2016) that the nation wants to develop scientifically and technologically for its development in all spheres of life. This development is expected to reflect in its education, economic and politics. For any nation, especially Nigeria to achieve scientific and technologically advanced, it becomes imperative to start planning for a firm Basic science and technology education foundation for her citizens from childhood. This is because children begin career exploration at a very young age. Basic Science and Technology is taught at the primary school level and to lay the foundation for the study of the core science subjects such as Biology, Physics, Chemistry and Geography at the senior secondary level of education, this cuts – across many other fields of human endeavour. In study Science the learners can obtain the knowledge from the systematic structure and behaviour of the physical world by observing, measuring and experimenting the developing of theories to describe the results of these activities (Ajayi and Ogbeba, 2017).

Teaching Basic Science and Technology to children at the basic education level, allows every Nigerian child to have basic knowledge and understanding of what science is all about and some of the innovations that have taken place. This assertion blends with the objectives of science teaching at the Upper Basic level of Education which is to produce individuals who will live effectively in the modern age of science and technology and contribute to the national development (FGN, 2013). Basic Science and Technology enables students to understand science concepts, principles, theories and laws as it further elaborated in the core sciences. As Basic Science and Technology is foundation level of future science, all children are expected to be grounded with elementary science to prepare them for sciences at advanced level because if the foundation level is faulty, the future science has no locus stand to build on and that is why Ogunjobi (2016) affirms that children should be exposed to the rudiments of science and technology education.

Basic Science and Technology at primary and junior secondary school level is meant to entrench inquiry-science skill that helps in sharpen the learner's intellectual developments and build their self-confidence in doing science. The study of Basic science and Technology gives students and

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teachers a chance to look at how science is essential to their development. It enables human organization to build huge industries through industrial science which can helped to improve *living standards and brought wealth and prosperity. However, with the introduction of Basic Science and Technology in our schools, the discipline has been faced with many challenges because there is public outcry about the poor performance of students as indicated in the Basic Education Certificate Examinations (BECE) in the last five years in National Examination Councils Examination (NECO, 2018 - 2022).*

Table 1
Performance of candidates in Federal Unity Colleges in North Central States, (BECE 2018 – 2022)

Year	Total sat	Credit	Pass	Failed
2018	4,600	2,065 (44.9%)	2,284 (49.7%)	269 (5.8%)
2019	5,193	2,422 (46.6%)	2,502 (48.2%)	269 (5.2%)
2020	4.479	1,980 (44.2%)	2.006 (44.8%)	493 (11.0%)
2021	4,905	2,049 (41.9%)	2,256 (45.9%)	600 (12.2%)
2022	3.325	1.355(40.8%)	1,646 (49.5%)	324 (9.7%)

Numerous factors have been attributed to the poor achievement in Basic Science and Technology in Nigeria especially North Central, these include inadequate use of instructional materials, lack of qualified and experienced science teachers, poor students' motivation and the most common being the use of poor instructional strategies*, the shortage of scientific equipment, over loaded of Basic Science and Technology curriculum, lack of laboratory facilities, the cognitive functioning of students, home conditions, peer group behaviour, school conditions, time allocated for Basic Science and Technology in the school time table, the attitude of students towards learning and emotional predisposition of students, inadequate pedagogical training for teachers resulting in poor teaching and learning, economic and sociocultural background of students, inability of the students to comprehend what is taught, failure of the students to retrieve the information or what is learn when the needs arise* (Wang, 2015).

The instructional strategy that a teacher adopts in the classroom has direct effects on achievement of the students. In view of the visible loop holes in the conventional strategy in Basic Science and Technology classrooms in north central and the obvious abysmal achievement by students, there is need for a paradigm shift from the conventional method to non - conventional teaching strategies *(*Balarabe, 2016) in other to makes teaching and learning meaningful to the learners.

The issue of students' under achievement level as a factor of differential learning outcome has attracted the attention of educational researchers. It is common in the conventional classroom to find students of mixed academic ability lumped together to be given the same treatment as if they have everything in common. In a normal Basic Science and Technology class, the entire population of the students have varieties of learning abilities. Their abilities are referred to as varied abilities. It is well known that every student has a different way of learning and progresses at different speeds. Thus, while some students may find the learning task easy to complete, others may find it difficult to understand. The weakness of students in Basic Science and Technology generally was linked to the fact that candidates lack basic concepts and not able to link Basic science and Technology concepts to real life situation (Lakpini and Atadoga 2012).

However, ability level varied and can be determined in three levels (i) High achievers, (ii) middle/average achievers and (iii) low achievers. Meanwhile, it is a widespread opinion that high ability students perform better than low ability students. The teaching and learning of Basic science and Technology at the junior secondary school level should take care of the low, medium and high ability students.

Instructional practices in the Basic Science and Technology classroom in Nigerian secondary schools, seems to favour only high ability students. Kaya (2015) assert that with the traditional teaching method, the gap between the achievements of high, medium and low ability students continue to widen. Thus, there is need to explore more approaches that will improve students achievement at all levels and instruction could be organized so that all students in the class can achieve at a high level. Burgin, et al, (2015); use of guided inquiry and problem solving teaching methods in teaching some concepts by Basic Science and Technology teachers may make Basic Science and Technology lesson objective stimulating and practical, also motivate the students to retain the knowledge gained from the lesson Guided inquiry and problem solving were more effective in achieving the learning objectives than lecture. In all reviewed studies, it was revealed that the use of Guided Inquiry and problem solving not only enhances the students' achievement, it also help them to retain the key concepts of the lesson. By adopting these teaching approaches to the present study, effort was made to determine its effectiveness on Basic Science and Technology students' s achievement at different levels and how it enhances their retention among the Unity college students in North Central, Nigeria

Retention plays a significant role in the understanding, comprehensibility and application of Science concepts. Retention means recalling pieces of knowledge, processes and skills that were learned earlier. The existence of academic institutions is based mainly on the belief that students remember what they know. It is the ability of individuals' working memory as some students are not able to retain knowledge or recall for a long time (short term memory) and others can store knowledge that has been retained for some time or for a long time (long term memory).

Retention consists of the ability to time that an instruction had been given. A learner can demonstrate their cognitive skill in the subject. Eziefula (2014) wrote that if learned materials should be retained, teaching/learning strategies should be well organized and appropriate skills should be used in teaching students. Eziefula, (2014), discussed factors that can facilitate retention, they are meaningfulness of materials, practice, repetition, formative evaluation and use of mnemonics over learning. Several studies have indicated that teaching methodology can improve learner's retention levels, Eziefula (2014) pointed out that using concrete objects in learning leads to better retention of information and development of

favourable attitude toward science.

Retention is defined by Akubuilo (2010) as a preservative factor of the mind and the mind acquires the materials of knowledge through sensation and perception. These acquired materials in the mind need to be preserved in the form of images for expertise to develop whenever a stimulating situation occurs; retained images are revived or reproduced to make memorization possible. Hence Basic Science and Technology concepts need to be presented to the learners in a way or method that touches their sub-consciousness which can trigger quick recalling of the image being taught or learnt using such a teaching method as guided inquiry and problem-solving learning strategies, all the students with different learning abilities would be able to collaborate in terms of understanding, explaining and retaining the concept they have learnt in a Basic Science and Technology class. Akubuilo (2010) reported that any instructional model, which elicits adequate student participation, has profound effects on students' retention.

In Nigeria, emphasis has not been laid on innovative strategies that can bridge gap between the high, medium, and low ability students. In addition, very few empirical studies exist in Nigeria regarding the use of Guided inquiry and Problem-solving strategies in Basic science and Technology. Thus, much remain to be empirically studied on the effects of Guided inquiry and Problem-solving approaches on students' ability levels and retention in Basic science and Technology education among the unity colleges in north central Nigeria

Research Questions: The following research questions guided the study:

1. What are the main effect of Guided Inquiry and Problem Solving approaches on Basic Science and Technology *Mean* ($\bar{x}$) retention scores among High, Medium and Low students in Unity Colleges?
2. What are the main effect of students ability (High, Medium and Low) on Basic Science and Technology *Mean* ($\bar{x}$) retention scores among Unity college students taught with Guided Inquiry and Problem Solving approaches?

Research Hypotheses: The following null hypotheses were formulated and will be tested at 0.05 level of significance

Ho_1: There is no significant difference in the main effect of Guided Inquiry and Problem-Solving approaches on Basic Science and Technology *Mean* ($\bar{x}$) retention scores among High, Medium and Low students in Unity Colleges

Ho_2: There is no significant difference in the main effect of students ability (High, Medium and Low) on Basic Science and Technology *Mean* ($\bar{x}$) retention scores among Unity college students taught with Guided Inquiry and Problem Solving approaches.

2. Methodology

Research Design: This study adopted Factorial 2x2x3 research design. Three levels of independent variables (two treatments and one control group), three groups of academic ability (low, medium, and high) and gender were employed in this study. The two experimental groups Guided inquiry (GI) and Problem-solving approach (PSA) and one control group (Traditional teaching method) BSTSAT was administered as pre-test before treatment and posttest after treatment. The experimental group 1 was subjected to treatment using Guided inquiry method (GI), the experimental group 2 was subjected to treatment using Problem solving approach (PSA) and the control group was taught using the conventional traditional method. The design layout is as shown in Table 2.

Sample and Sampling Technique:

The sample for the study was made up of 373 (male = 198 and female 175) students. A multi-stage sampling technique was used to select the samples for the study. Multi-stage sampling technique for a population that is divided as the North-central states are: First, stratified sampling technique (7 states strata) from unity colleges. Secondly, a purposive sampling technique was used to select one third of the schools from (three states) in the North-central states. thirdly, random sampling was used to select the students in the streams of JSS3 classes available in the school was further divided into 3 classes for Experiment 1, Experiment 2 and Control Groups. Finally, Subjects were stratified into different ability levels based on their performance in the previous examination.

The criteria for high ability students were based on students whose previous average in the

Basic science and Technology examination fell within the first 25% (1st quartile), the medium ability students' score within the middle 50% while the low ability level students fell within the lower 25%.

Research Instruments: It consists of three instruments, that covered topics from the Family Traits (Cell, Family Tree, Hereditary Traits and Inheritance)

Treatment instruments:

Three (3) treatment instruments were developed by the researcher, these are Basic Science and Technology Guided Inquiry Lesson Plan (GILP) The lesson plan was designed based on the 5E learning cycle which are; Engage, Explore, Explain, Elaborate, and Evaluate. Basic Science and

Table 2
Factorial design layout

Group	Academic Ability	Instructional Approaches	Dependent Variable	Instructional Approach	Dependent Variable
1	High	GIA	Post-Test, Post Post-Test (BSTSAT Score)	GIA	Post-Test, Post Post Test (BSTSAT Score)
2	Medium	GIA	Post-Test, Post Post-Test (BSTSAT Score)	GIA	
3	Low	GIA	Post-Test, Post Post-Test (BSTSAT Score)	GIA	
4	High	PSA	Post-Test, Post Post-Test (BSTSAT Score)		
5	Medium	PSA	Post-Test, Post Post-Test (BSTSAT Score)		
6	Low	PSA	Post-Test, Post Post-Test (BSTSAT Score)		
7	High	TA	Post-Test, Post Post-Test (BSTSAT Score)		
8	Medium	TA	Post-Test, Post Post-Test (BSTSAT Score)		
9	Low	TA	Post-Test, Post Post-Test (BATSAT Score)		

Technology Problem-solving Lesson Plan (PSLP) based on PSLP Teaching and Learning cycle which are: Understand the Problem, Explore the Curriculum and Resolve the Problem and Conventional (lecture) Method Lesson Plan.

Test instruments:

The instrument for data collection is Basic Science and Technology Students' Retention Test (BSTSRT) The BSTSRT has 50 multiple choice objective items adopted from the past Junior Secondary School Certificate Examination (BECE). The BSTSRT is completely based on JSS curriculum on concepts of Family Traits (Cell, Family Tree, Hereditary Traits and Inheritance). These topics are selected from the Junior Secondary School II1 (JSSIII) Basic Science and Technology syllabus. Each question has multiple-choice with four options (A-D) as possible answers to the question. Students are required to choose the correct answer by ticking on the letter (A-D) that corresponds to the right answer. Only one of the four options is the correct answer.

Validity and reliability: The instrument was validated by the expert from science education, measurement and evaluation and experienced senior teachers in Basic science and Technology while reliability of the instrument was ascertained with use of Pearson Product Movement Correlation (PPMC). The reliability coefficient of 0.86 was obtained

Experimental procedure:

Basic science and Technology Students Retention Test (BSTSRT) was given as pre-test. The main objective of administering the pre-test is to ascertain the academic equivalent of the students in Basic science and Technology before the commencement of the experiment. Treatment followed after and lasted for four weeks based on school timetable and scheme of work. Immediately after treatment post -test was conducted.

3. Result

Three statistical tools employed to analyse the scores obtained from the selected samples in the study. *Mean* ($\bar{x}$) and Standard deviation (s) were used to answer the research questions. The null hypotheses were analysed using Analysis of Variance (ANOVA) and Analysis of Co- variance (ANCOVA), Sidak Post-Hoc Multiple Comparison (SPMC) and Students Package for Social Sciences (SPSS) version 23.0. Descriptive charts were used to describe the research questions and null hypotheses.

Research Question 1: What are the main effect of Guided Inquiry and Problem Solving approaches on Basic Science and Technology *Mean* ($\bar{x}$) retention scores among High, Medium and Low students in Unity Colleges?

The result in Table 3 indicates the mean and standard deviation of the post-test and retention of Guided Inquiry, problem-solving and Traditional methods. The post-test mean of the three groups were 61.59, 57.49 and 48.27 respectively, while the standards deviation was 5.37, 8.67 and 5.98 respectively. The retention means and standard deviation of Guided Inquiry, problem-solving and Traditional method are 56.41, 54.86 and 52.55, while the standard deviation was 5.55, 9.12 and 8.37 and the mean gain of the three groups were 5.18, 2.63, and 4.28 respectively.

The three groups improved on their Basic science and Technology achievement. However, students that learn with Guided Inquiry strategy had the highest mean gain of 61.59, and the problem-solving strategies mean 57.49, while the traditional method has the least mean gain of 48.27. Therefore, Guided Inquiry, and problem-solving strategies are more effective in enhancing students' achievement in Basic science and Technology.

Research Question 2: What are the main effect of students ability (High, Medium and Low) on Basic Science and Technology *Mean* ($\bar{x}$) retention scores among Unity college students taught with Guided Inquiry and Problem Solving approaches?

Result in Table 4 indicates the mean and standard deviation of the pretest and post-test of Guided Inquiry, (High, Medium and Low) The pretest mean of the High, Medium and Low were 21.33, 19.13 and 26.94, respectively, and standard deviation were 6.12, 6.94 and 8.65, respectively. Similarly, the post-test means of High, Medium and Low were 66.63, 59.42 and 61.04 respectively, the mean gain was 45.3, 40.29, and 34.1 respectively. The Problem-Solving (High, Medium and Low) pretest mean score were 24.43, 41.26, and 20.37, respectively, while the standard was 5.08, 5.26 and 8.27, respectively. Similarly, the post-test mean score of High, Medium and Low

Table 3
Comparison of mean and standard post-test and retention results for guided inquiry, problem-solving strategies and traditional methods in basic science and technology

Group		Post-test		Retention		Mean Gain
		Mean	SD	Mean	SD	
Guided Inquiry	143	61.59	5.37	56.41	5.55	5.18
Problem-solving	120	57.49	8.67	54.86	9.12	2.63
Traditional Method	110	48.27	5.98	52.55	8.37	4.28

Table 4
Comparison of the mean and standard deviation of pretest and post-test results for guided inquiry and problem solving and traditional method in basic science and technology retention

Group		N	Pretest		Post-test		Mean Gain
	Ability		Mean	SD	Mean	SD	
Guided	High	27	21.33	6.12	66.63	5.87	45.30
Inquiry	Medium	45	19.13	6.94	59.42	4.17	40.29
	Low	71	26.94	8.65	61.04	4.67	34.10
Problem-Solving	High	23	24.43	5.08	67.78	6.02	43.35
	Medium	46	14.26	5.26	52.96	5.59	38.70
	Low	51	16.37	8.27	56.94	8.18	41.57

were 67.78, 52.96, and 56.94, with standard deviation of 6.02, 5.59, and 8.18, and the mean gain was 43.35, 38.7, and 36.57 respectively. However, students that learn with Guided Inquiry method strategy had the highest mean gain of 45.30, and the problem-solving strategies mean. Therefore, problem-solving (Low) strategies as the high mean gain of 41.57 which higher than the mean of the medium achievers of the guided inquiry and problem solving indicating that problem-solving strategy was more effective in reducing the achievement gap between high and medium achievers

Research Hypotheses 1: Ho_1: There is no significant difference in the main effect of Guided Inquiry and Problem-Solving approaches on Basic Science and Technology *Mean* ($\bar{x}$) retention scores among High, Medium and Low students in Unity Colleges.

Table 5 shows the main effects instructional approaches (guided inquiry, problem-solving and traditional method) on students' retention score There was a significant difference in the retention score in Basic science and technology achievement between the three groups, F (2,369) = 84.071, p = (0.00 <0.05). The partial η2 = 0.313, indicating that only 31.3% of the total variance is accounted for by the instructional approaches. To determine the direction of the significant difference, Sidak multiple comparisons was conducted and the result is presented in Table 6.

Sidak post-hoc analysis on Table 6 indicated that the observed significant difference was between the group taught with guided inquiry and traditional method with a mean difference of 9.05. Similarly, a significant difference exists between students taught with Problem-solving and Guided Inquiry and Traditional Method with the mean difference of .157, and 9.212, respectively

Ho_2: There is no significant difference in the main effect of students ability (High, Medium and Low) on Basic Science and Technology *Mean* ($\bar{x}$) retention scores among Unity college students taught with Guided Inquiry and Problem Solving approaches

Results in Table 7 show post-test findings of Guided Inquiry, problem-solving, and traditional instructional strategies on Basic Science and Technology retention scores. The value F (8, 363) = 62.843, *P*= (0.00) < 0.05, indicates a significant difference between the mean Basic Science and Technology students taught with Guided Inquiry, Problem-solving, and Traditional group retention in basic science and Technology. Therefore, the hypothesis was rejected. The partial eta square (n^2) (0.581) shows that the effect of instructional strategies accounts about 60% of total variances in Basic Science and Technology achievement (dependent variable). To determine the direction of the significant difference, Sidak multiple comparisons was conducted and the result is presented in Table 8.

Sidak post-hoc analysis on Table 8 indicated that there is a significant difference between guided inquiry High and Guided Inquiry Medium, Guided Inquiry Low, Problem-Solving Medium, Problem Solving Medium, Problem Solving Low, Traditional Method High, Traditional Method Medium, Traditional Method Low with the mean difference as follows;

Table 5
ANCOVA result for guided inquiry-based, problem-solving traditional method on basic science and technology students' retention score

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	12559.803[a]	3	4186.601	114.428	.000	.482
Intercept	111490.035	1	111490.035	3047.253	.000	.892
Pretest	3516.623	1	3516.623	96.117	.000	.207
Group	6151.825	2	3075.912	84.071	.000	.313
Error	13500.626	369	36.587			
Total	1055980.000	373				
Corrected Total	26060.429	372				

a. R Squared = .482 (Adjusted R Squared = .478)

Table 6
Sidak Post-Hoc multiple comparison of the retention score of basic science and technology students taught basic and technology with guided inquiry, problem solving and those taught with traditional method

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.[b]
Guided Inquiry	Problem Solving	-.157	.769	.996
	Traditional Method	9.054*	.804	.000
Problem Solving	Guided Inquiry	.157	.769	.996
	Traditional Method	9.212*	.801	.000
Traditional Method	Guided Inquiry	-9.054*	.804	.000
	Problem Solving	-9.212*	.801	.000

Table 7
ANCOVA result for guided inquiry-based, problem-solving traditional method on basic science and technology mean retention scores of high, medium and low ability levels

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	17820.305[a]	9	1980.034	87.226	.000	.684
Intercept	89007.240	1	89007.240	3921.012	.000	.915
Pretest	2822.789	1	2822.789	124.352	.000	.255
Ability	11412.326	8	1426.541	62.843	.000	.581
Error	8240.124	363	22.700			
Total	1055980.000	373				
Corrected Total	26060.429	372				

R Squared = .684 (Adjusted R Squared = .676)

Table 8
Sidak Post-Hoc multiple comparison result of guided inquiry-based, problem-solving traditional method and gender on basic science and technology students mean retention scores of high, medium and low ability levels

(I) Ability	(J) Ability	Mean Difference (I-J)	Std. Error	Sig.[b]
Guided Inquiry High	Guided Inquiry Medium	6.095*	1.162	.000
	Guided Inquiry Low	8.145*	1.095	.000
	Problem Solving Medium	11.137*	1.181	.000
	Problem Solving Low	4.356*	1.134	.005
	Traditional Method High	10.666*	1.396	.000
	Traditional Method Medium	13.049*	1.240	.000
	Traditional Method Low	18.290*	1.144	.000
Guided Inquiry Medium	Guided Inquiry High	-6.095*	1.162	.000
	Guided Inquiry Low	2.050	.948	.682
	Traditional Method High	4.571*	1.251	.011
	Traditional Method Medium	6.954*	1.076	.000
	Traditional Method Low	12.195*	.995	.000
Guided Inquiry Low	Guided Inquiry High	-8.145*	1.095	.000
	Problem Solving Medium	2.992	1.006	.106
	Traditional Method High	2.522	1.267	.825
	Traditional Method Medium	4.904*	1.086	.000
	Traditional Method Low	10.145*	.894	.000
Problem Solving High	Guided Inquiry High	2.144	1.356	.988
	Guided Inquiry Medium	8.239*	1.235	.000
	Guided Inquiry Low	10.289*	1.146	.000
	Problem Solving Medium	13.281*	1.268	.000
	Problem Solving Low	6.500*	1.205	.000
	Traditional Method High	12.811*	1.478	.000
	Traditional Method Medium	15.193*	1.328	.000
	Traditional Method Low	20.434*	1.205	.000
Problem Solving Medium	Guided Inquiry High	-11.137*	1.181	.000
	Traditional Method Medium	1.912	1.047	.922
	Traditional Method Low	7.153*	1.029	.000
Problem Solving Low	Guided Inquiry High	-4.356*	1.134	.005
	Guided Inquiry Medium	1.739	.975	.941
	Guided Inquiry Low	3.788*	.904	.001
	Problem Solving Medium	6.781*	.992	.000
	Traditional Method High	6.310*	1.237	.000
	Traditional Method Medium	8.692*	1.059	.000
	Traditional Method Low	13.934*	.959	.000
Traditional Method High	Guided Inquiry High	-10.666*	1.396	.000
	Problem Solving Medium	.470	1.221	1.000
	Traditional Method Medium	2.382	1.259	.889
	Traditional Method Low	7.624*	1.275	.000
Traditional Method Medium	Guided Inquiry High	-13.049*	1.240	.000
	Guided Inquiry Medium	-6.954*	1.076	.000
	Guided Inquiry Low	-4.904*	1.086	.000
	Problem Solving High	-15.193*	1.328	.000
	Problem Solving Medium	-1.912	1.047	.922
	Problem Solving Low	-8.692*	1.059	.000
	Traditional Method High	-2.382	1.259	.889
	Traditional Method Low	5.241*	1.100	.000

6.095, 8.145, 11.137, 4.356, 10.666, 13.049, and 18.290, respectively. Similarly, a significant difference exists between guided inquiry Medium and problem-solving medium, Traditional Method Medium, Traditional Method Low with the mean difference of 11.137, 6.954, and 12.195, respectively.

There is a significant difference between Guided Inquiry Low and Traditional Method Medium (4.904), and Traditional Method Low (10.289). A significant difference exists between problem-solving high achievers and Medium and low achievers of Guided inquiry, medium and low achievers of Problem solving and high, medium and low achievers of the traditional group. It is important to highlight that a significant difference also exist between Problem-solving medium and low achievers, and traditional medium and low achievers.

A. Discussion of Results

The findings on the main effect of Guided inquiry and Problem-solving approaches on Basic science and Technology *Mean (*$\bar{x}$) retention scores among High, Medium and Low students in Unity colleges. The result shows that there are main effects of instructional approaches (Guided inquiry, Problem solving and Traditional method) on students' retention scores. There was a significant difference in the retention scores between the three groups indicating that the total variance is accounted for by the instructional approaches. To determine the direction of significant difference Sidak multiple comparisons was conducted and result indicated that the observed significant difference was between the group taught with Guided inquiry and Traditional method with a mean difference Similarly a significant difference also exist between students taught with Problem solving and Guided inquiry and Traditional method with the mean difference respectively. The analysis on students' scores according to ability level revealed that high ability students were significantly better in term of retention of learned materials than the average ability level, which in turn retained

more of the learned Basic science and Technology concepts than the low ability students according to Moses, (2018). That means the treatment favoured the two experimental groups than the control group in term of retention of Basic science and Technology students in Unity Colleges. The result is line with Enebechi, (2021) that Inquiry based learning approach is more effective than the conventional approach in enhancing students 'retention in Biology. Also, in agreement with Moses, (2018), that reflective inquiry teaching method enhances retention abilities in students when used in teaching domestic installation. In line with the findings the result of the study conducted by Ezema, *et al,* (2017), equally revealed that the experimental group had higher mean achievement scores than their counterpart in control group. The result equally revealed that the students in experimental group had higher mean retention scores than the control group taught using the Conventional method. In similar way the result of study carried out by Mohammed and Ali, (2017) revealed that students taught with Guided inquiry instructional strategy had higher academic achievement and retention than the those taught with the lecture method

The findings on the main effect of students' ability (High, Medium and Low), on Basic science and Technology *Mean* ($\bar{x}$) retention scores among Unity colleges students taught with Guided inquiry and Problem-solving approaches. The result revealed that a significant difference exists between problem-solving high achievers and Medium and low achievers of Guided inquiry, medium and low achievers of Problem solving and high, medium and low achievers of the traditional group. It is important to highlight that a significant difference also exist between Problem-solving medium and low achievers, and traditional medium and low achievers. The result indicated that the treatment favoured the all-ability levels under Guided inquiry and problem solving than the ability levels under traditional method, the result is in agreement with Obochi, (2018), that Problem solving had significant effects on the academic performance of the students of low ability students that were taught Biology using problem solving strategy and also retained the learn concepts better than those taught using lecture method. Like Liu, *et-al.* (2019), reported that students' performance is directly related to his or her ability or competences and not too far from what Okobiah, (2012), that differences between low – medium and high achieving students are closely linked to the instructional methods used in delivering the curriculum. This implies that the students' ability to understand scientific concepts and phenomenon may largely determine their achievement and retention in Basic science and Technology curriculum depending on the instructional delivery methodology

4. Conclusion

This study revealed that Guided inquiry and Problem-solving approaches enhanced students' achievement and retention more in Basic science and Technology. Guided inquiry and problem solving generates more learning outcome than the Traditional teaching method. Guided inquiry and Problem-solving approaches improved high, medium and low ability students' achievement and retention equally. This can serve as a medium of bridging the gaps between low, medium and high ability students in Basic science and Technology among the unity colleges in North central, Nigeria.

5. Recommendations

Based on the findings of this study, it is recommended that the Guided inquiry and Problem solving should be incorporated into the teaching method adopted to Basic science and Technology since they have the capability to enhance the students' academic achievement and retention. Guided inquiry and Problem-solving approaches should be encouraged as it allows the learners to construct the materials to be learned and the task to be performed, select the relevant information and interpret it to attained desired learning outcomes

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