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Effects of Assertive Questioning and Prior Knowledge of Behavioral Objectives Teaching Strategies on Achievement of Students with Different Abilities in Biology

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Abstract **– The study investigated how the achievement of students with different ability groups could vary when taught secondary biology using Assertive Questioning and Prior Knowledge of Behavioral Objectives, in Benue State, Nigeria. Five research questions were raised and five hypotheses formulated and tested at 0.05 level of significance. A quasi-experimental, non-randomized control group pretest and posttest research design was adopted. The population comprised 8,571 senior secondary two (SSII) students, out of which 264 students were sampled, from six government grant-aided schools, using multistage sampling technique. Data were generated using researcher constructed Ability Group Test (AGT) and Biology Achievement Test (BAT), along with five lesson plans each for respective instructional packages. Face and content validity of instruments were done by experts in Science Education and Test & Measurement. AGT and BAT had reliability coefficients of 0.98 and 0.72 respectively, using Kuder-Richardson formula 21 (KR_{21}). Data collected were analyzed using means and standard deviations to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses. The findings of the study revealed that there was significant difference in the mean achievement scores of students taught cellular respiration and excretory system in Biology using assertive questioning strategy, Prior knowledge behavioral strategy and lecture method ($F(2, 264) = 18.895$; $P = 0.000 < 0.05$). There was a significant difference among the mean achievement scores of students of varied abilities taught cellular respiration and excretory system in Biology using assertive questioning strategy ($F(2, 83) = 18.200$; $P = 0.000 < 0.05$). Similarly there was significant difference between the mean achievement scores of students of varied abilities taught cellular respiration and excretory system using prior knowledge behavioral objectives strategy ($F(2, 95) = 18.895$; $P = 0.017 < 0.05$). Results however revealed no significant difference between the mean achievement scores of male and female students taught cellular respiration and excretory system using assertive questioning strategy ($F(1. 83) = 0.032$; $P = 0.859 > 0.05$). Furthermore, there was no significant difference between the mean achievement scores of male and female students taught cellular respiration and excretory system using prior knowledge behavioral objective strategy ($P = 0.154 > 0.05$). Based on the findings, it was recommended among others that teachers of Biology should use assertive questioning strategy and prior knowledge of behavioral objectives strategy to improve the academic achievement of students with different abilities.**

Keywords **– Assertive, Questioning, Prior-Knowledge, Behavioral Objectives, Abilities & Achievement.**

I. INTRODUCTION

Science is a way of knowing things about the universe. The study of science provides bases for utilization of facts, theories, laws and principles in technology. The technological dimension of the development of any knowledge base society is tied to the scientific breakthrough in science [24]. Therefore, there is the need for proper dissemination of science education in senior secondary schools. Several research reports indicate that students achieve poorly in secondary school science subjects especially Biology [1].

Biology is the natural science that studies life and living organisms, including their physical structure, chemical processes, molecular interactions, physiological mechanisms, development and evolution. The study of Biology is important to human beings because of the immense benefit derived from it. Human health sustenance and environment are all based on biological processes and each can be improved upon through the application of biological knowledge. According to "reference [17]", human activities which involve biological activities are economically important and include for instance the production and procession of agricultural produce, medicine, food and nutrition, fermented drinks, tobacco, and fabric. All these socio-economic activities are gained from purposeful application of Biology.

In view of these benefits accruing from the study of Biology, Nigeria has been making efforts toward the improvement of Biology in schools. Biology curriculum in Nigerian secondary schools is designed to continue to deepen students' understanding and interest in Biology and also encourage students to apply scientific knowledge to everyday life in matters of personal, community health and agriculture [7]. One of the primary functions of Biology teaching is to help students understand Biology concepts, principles, theories and laws [30]. Biology teaching also involves exposing students to several opportunities to understand different types of concepts and principles as well as expose them to direct physical materials that will make more meaning to the cognitive framework of the child [20].

Based on the foregoing, the relevant learning expectations from the teaching of Biology could be met if the subject is handled properly by the teachers involved using appropriate teaching strategies. "Reference [23]" stated that there is poor understanding of Biology concepts due to use of inappropriate teaching methods. No matter how good and well planned a curriculum may be, the use of inappropriate methods of teaching by the teachers can work against its successful implementation that may lead to poor understanding as well as poor achievement by the students [21].

Biology concepts could be difficult sometimes particularly when describing abstract ideas that cannot be easily understood by the students at first instance, and quite often, poorly taught by the teacher. These concepts in Biology curriculum often task the intellectual capability of the students to learn with attendant poor achievement when they encounter these concepts in the senior secondary school certificate examinations. It has been reported that cellular respiration and excretory system are among the various concepts in Biology that are perceived as being difficult to learn [29]; and students have poor understanding of cellular respiration and excretory system due to inappropriate teaching method often used by the teachers.

Cellular respiration is an aspect of Biology that deals with the metabolic reactions and processes that take place in the cells of organisms to convert biochemical energy from nutrients into adenosine triphosphate (ATP), and then release waste products. The knowledge of cellular respiration is important because it provides the energy for living organisms to perform all of the other necessary functions to maintain life. Excretion is the process by which metabolic waste is eliminated from an organism using various organs such as lungs, kidney and skin. Excretion is an essential process in all forms of life because it gets rid of products which are harmful to the body. The knowledge of these concepts is important to the students and the teachers therefore need to effectively teach them to the students using method that will enhance the students' understanding.

The conventional instructional strategy such as the lecture method often used in teaching Biology has not improved students' achievement in the subject to any appreciable extent [23]; [16]; [14]. This implies that the

teaching of biology has not led to students' understanding of the concepts. Therefore, there is the need to find other pragmatic teaching strategies such assertive questioning and prior knowledge of behavioural objectives teaching methods to enhance students' achievement in Biology.

Assertive questioning as described by "reference [5]" is the type of instructional technique which the teacher asks the class a thought-provoking question and monitors the students' reasoning; the teacher checks for completion and get a number of answers; the class scrutinizes the answer and the teacher confirms the correctness of the answer and reinforces the individual or group that provides the answer. Assertive questioning is a teaching tool that when used for teaching maximizes students' participation in the class and generates active learning [5]. It is a means of provoking students to reason critically about the concept presented to them thereby stimulating their cognitive structure. This implies that assertive questioning can hugely increase students' concentration and participation in the class in order to enhance interest of the learning material.

Studies using assertive questioning strategy are relatively scarce to the best of the researcher's knowledge. However several studies using questioning method have been carried out in sciences [15]; [3] with conflicting conclusions while some inconsistent results have also been reported [16]. This has necessitated further studies on the effect of assertive questioning on students' achievement. The use of assertive questioning was investigated to determine the effect it might have on achievement of senior secondary two Biology students of different ability groups in Benue State, Nigeria. The assertive questioning technique like the prior knowledge of behavioural objective technique is a key strategy that may enhance students' achievement in Biology.

Prior knowledge of behavioural objectives teaching strategy is a technique of setting learning objectives before the commencement of instruction [13]. Objectives according to [8] are a result of an action or process. "Reference [6]" pointed out that learning objective is what results from a learning process and are statements that predict what learners will have gained as a result of learning. Some definitions stress that a learning objective is a sort of contract that teachers make with learners that describes what they will be able to do after learning, what they could not do before. It is therefore, likely that if teachers let the students to be aware of what is expected of them by the end of the lesson they about to teach, it may improve the achievement and interest of the students.

In any given subject, achievement is one of the major parameters used in assessing the progress of students in an academic programme. The students' achievement could be used by the teacher as an indicator in assessing his teaching and methodology. This evaluation is crucial as it enable the teacher to find out different variables that might militate against students' performance such as attitude and interest. In Nigeria, there is clear evidence of under achievement in Biology by the students at the senior secondary school certificate examinations [19]; [27]. This implies that most students at completion of their secondary school Biology courses fail to attain the pass grades. The question that may arise from this scenario is why are the students not succeeding in Biology in their secondary school certificate examination? Several reasons may account for this trend. "Reference [12]" attributed the poor achievement to the use of lecture method in teaching secondary school Biology. It is therefore, hopeful that the use of assertive questioning and prior knowledge of behavioural objectives may likely address the problem of poor achievement in Biology.

Furthermore, ability groupings and gender could sometimes have tremendous impact on how students learn and invariably affect their understanding and achievement in various subjects. In Nigerian secondary schools,

students are placed in different classes that reflect their intellectual capability because they may have passed common placement examinations conducted by the school, yet, the students' mental abilities differ when presented with a given task. This has necessitated identifying such students to help them improve their academic performance.

According to "reference [28]" ability grouping is the practice of grouping students based on their ability and achievement in an attempt to provide instruction specifically relevant to each group's needs. The two most common variants in the ability grouping of students are within-class and between-class ability groups [28]. "Reference [28]" revealed that the within-class grouping is the practice of dividing a class of students with diverse abilities into groups based on ability and achievement level whereas, the between-class grouping is the system in which students are separated into different classes based on ability levels. Gender is implicated in science education in the area of relative participation rate of boys and girls in science subjects.

II. Statement of the Problem

In spite of the recommendation by science educators, Science Teacher's Association of Nigeria (STAN) and researchers to use constructivists teaching methods in teaching sciences, evidences abound of the under-achievement of senior secondary school students in WAEC and NECO examinations with more than 60% of candidates unable to attain credit level in the past ten years [27]. This state of poor achievement of students in Biology in spite of its numerous benefits to mankind, and as a basic prerequisite subject at the senior secondary school level for entry into many professional courses such as medicine, pharmacy, nursing and biotechnology has been the concern of the students, teachers, parents and employers of labour places a demand for the present study.

The use of inappropriate teaching strategy has been found to be the major factor responsible for students' poor achievement. The situation is worsened by paucity of an appropriate teaching method that will not only be valid and reliable in enhancing students' achievement in Biology, but will be better in enhancing the achievement of students of different ability groups. Therefore, the problem of this study posed as question is; what are the effects of the use of assertive questioning and prior knowledge of behavioural objectives teaching methods on achievement of students of different abilities in Biology?

III. Research Questions

1. What are the mean achievement scores of students taught cellular respiration and excretory system in biology using assertive questioning instructional strategy, prior knowledge of behavioural objectives and lecture method?
2. What are the mean achievement scores of students of varied abilities taught cellular respiration and excretory system in biology using assertive questioning strategy?
3. What are the mean achievement scores of students of varied abilities taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives strategy?
4. What are the mean achievement scores of male and female students taught cellular respiration and excretory system in biology using assertive questioning strategy?
5. What are the mean achievement scores of male and female students taught cellular respiration and excretory

system in biology using prior knowledge of behavioural objectives strategy.

IV. HYPOTHESES

1. There is no significant difference in the mean achievement scores of students taught cellular respiration and excretory system in biology using assertive questioning instructional strategy, prior knowledge of behavioural objectives strategy and lecture method.
2. There is no significant difference among the mean achievement scores of students of varied abilities taught cellular respiration and excretory system in biology using assertive questioning strategy.
3. There is no significant difference between the mean achievement scores of students of varied abilities taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives strategy.
4. There is no significant difference between the mean achievement scores of male and female students taught cellular respiration and excretory system in biology using assertive questioning strategy.
5. There is no significant difference between the mean achievement scores of male and female students taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives strategy.

V. METHODOLOGY

The study adopted quasi-experimental, non-randomized control group pretest and posttest design to measure the comparative effects of the use of assertive questioning strategy, prior knowledge of behavioural objectives strategy and lecture method on achievement and interest of SSII Biology students of different ability groups in Benue State, Nigeria. The population for the study comprised 8,571 senior secondary II biology students in the 2018/ 2019 academic session. The sample comprised 265 SSII biology students from six government grant-aided secondary schools. Using multistage sampling technique, purposive sampling technique was adopted in selecting the six schools out of the 4, 283 schools in the study area. The use of purposive sampling was to ensure, that all schools are represented based on the three educational zones of Benue State. Hat and draw approach was used to randomly assign two schools each to experimental group 1, experimental group 2 and the third one as control group. The use of hat and draw technique was to ensure that all the schools are given a fair chance of been selected. In each of the selected schools, intact classes were used in order to avoid inter - group interaction. The students in the first experimental group was taught using assertive questioning method and the second experimental group was taught using prior knowledge of behavioural objectives strategy while the control group was taught using the conventional (lecture) method.

Two instruments constructed by the researcher were used for collection of data for the study. They are; Ability Group Test (AGT) and Biology Achievement Test (BAT). Ability Group Test (AGT), is a 20-item multiple choice tests adapted from [31]. The test questions were read to the students by the researcher and they were allowed one minute to provide answers to each question. The mean scores obtained by the students were used to categorize them into high, medium and low ability groups. The present study adopted the grading system of the AGT according to [28] recommendation, with modifications which identified students with a mean score of 7.5 and above as high ability students, students with mean score of 4.5-6.5 as medium ability students, and st-

-udents with mean score of 3.5 and below as low ability students.

Biology Achievement Test (BAT), adapted from [10] with initial 36-items before validation consists of 30-items multiple choice questions with four detractors drawn from the topics of cellular respiration and excretory system based on the current senior secondary school syllabus. The BAT with its marking scheme was used for both pretest and posttest. The scores obtained were analyzed to determine the effectiveness of various methods of instruction.

The lesson plans on the concepts of cellular respiration and excretory system were prepared by the researcher in line with the principles of assertive questioning and prior knowledge of behavioural objectives strategies to the experimental groups while the control group was taught using lesson plans on the same concepts prepared by the researcher in line with lecture method. The lesson plans contain the teacher's and students' activities that were performed in the course of the teaching at each stage of instruction. They also contain instructional materials that enabled students to achieve maximally. The teacher took the role of facilitator to guide students in classroom instructional process. The students in the experimental groups received lessons as a group and attended class activities on an individual basis. The control group was a normal class that was taught by the research assistants.

The reliability coefficients of the instruments were calculated using Kuder-Richardson formula 21 and were found to be 0.98 for AGT and 0.72 for BAT. Mean, bar graph and standard deviation were used to answer the research questions awhile Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance.

VI. RESULTS

The following results were obtained and discussed after data collected were analyzed variously:

Research Question One:

What is the mean achievement score of students taught cellular respiration and excretory system in biology using assertive questioning instructional strategy, prior knowledge of behavioural objectives and lecture method?

Table 1. Mean achievement score of students taught Biology using assertive questioning Strategy, prior knowledge of behavioural objectives and lecture method.

GROUP		PREBAT	POSTBAT	Mean Gain
Assertive Questioning Instructional Strategy	Mean	41.6429	57.7143	16.07
	N	84	84	
	Std. Deviation	11.49504	12.46641	
Prior Knowledge of Behavioural Objectives Strategy	Mean	41.4583	61.9063	20.45
	N	96	96	
	Std. Deviation	10.94283	12.28099	
Lecture Method	Mean	42.3059	52.4235	10.12
	N	85	85	
	Std. Deviation	11.48086	13.81543	

The analysis of data on Table 1 shows the mean achievement score of students taught cellular respiration and excretory system in biology using assertive questioning instructional strategy, prior knowledge of behavioural objectives and lecture method. The table reveals that the mean achievement scores of students taught cellular respiration and excretory system in biology using assertive questioning instructional strategy is 41.64 with a standard deviation of 11.50 during pre-test and 57.71 with a standard deviation of 12.46 in posttest. The mean achievement scores of students taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives is 41.46 with a standard deviation of 10.94 during pre-test and 61.91 with a standard deviation of 12.28 in posttest. While the mean achievement scores of students taught cellular respiration and excretory system in biology using lecture method is 42.31 with a standard deviation of 11.48 during pre-test and 52.42 with a standard deviation of 13.82 in posttest, the table further shows that the mean gain for assertive questioning instructional strategy is 16.07, while that of prior knowledge of behavioural objectives is 20.45 and lecture method is 10.12. The summary of the Pretest, Posttest Mean achievement score of students taught biology using assertive questioning instructional strategy, prior knowledge of behavioural objectives and lecture method is as shown in Fig. 1.

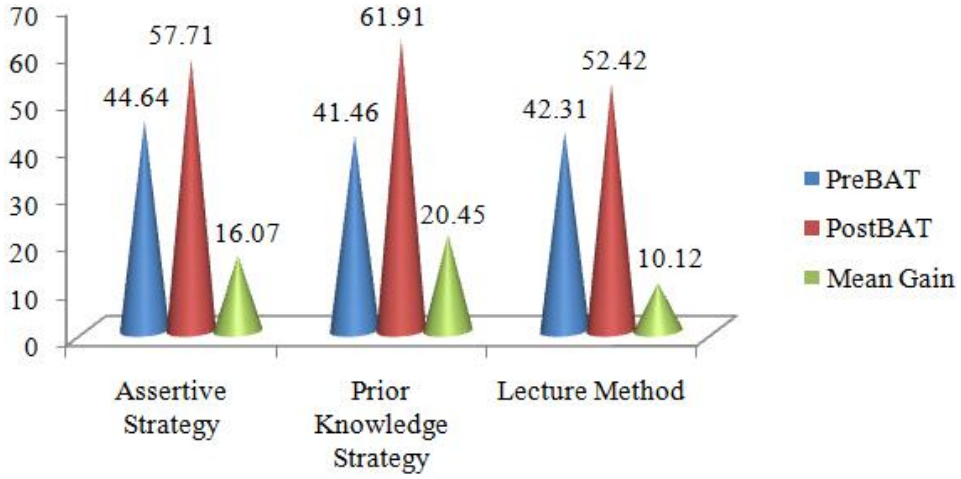

Fig. 1. Pretest, Posttest mean achievement score of students taught Biology using assertive questioning instructional strategy, Prior knowledge of behavioural objectives and lecture method.

VII. Research Question Two

What is the mean achievement score of students of varied abilities taught cellular respiration and excretory system in biology using assertive questioning?

Table 2. Mean achievement score of students of Varied abilities taught Biology using assertive questioning.

Ability Group		Pre BAT	Post BAT	Mean Gain
High Ability	Mean	47.0000	68.8846	21.88
	N	26	26	
	Std. Deviation	10.79630	12.76660	
Moderate Ability	Mean	40.9000	54.3750	13.48
	N	40	40	
	Std. Deviation	10.68860	7.52666	

Ability Group		Pre BAT	Post BAT	Mean Gain
Low Ability	Mean	35.5556	49.0000	13.44
	N	18	18	
	Std. Deviation	11.27841	9.57325	

The analysis of data on Table 2 shows the mean achievement scores of students of varied abilities taught cellular respiration and excretory system in biology using assertive questioning. Results shows that the mean achievement scores of high ability students taught using assertive questioning instructional strategy is 47.00 with a standard deviation of 10.79 during pre-test and 68.88 with a standard deviation of 12.76 in posttest. The mean achievement scores of moderate ability students was 40.90 with a standard deviation of 10.69 during pre-test and 54.38 with a standard deviation of 7.53 in posttest. While the mean achievement scores of low ability students' is 35.56 with a standard deviation of 11.28 during pre-test and 49.00 with a standard deviation of 9.57 in posttest. The table further shows that the mean gain for high ability is 21.88, while that of moderate ability is 13.48 and low ability is 13.44. The summary of the mean gain in achievement score of students of high, moderate and low abilities taught cellular respiration and excretory system in biology using assertive questioning is as shown in fig. 2.

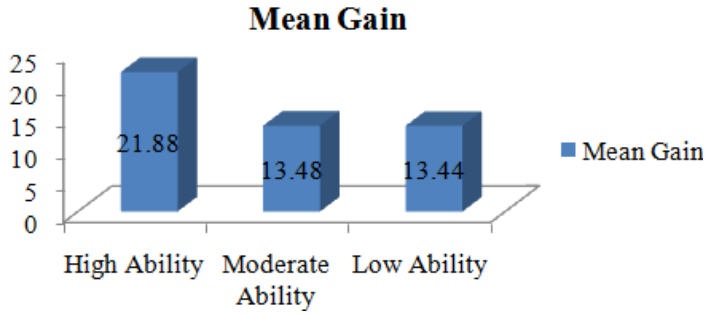

Fig. 2. Mean gain achievement scores of students of varied abilities taught cellular respiration and excretory system in Biology using assertive questioning.

VIII. Research Question Three

What is the mean achievement score of students of varied abilities taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives strategy?

Table 3. Mean Achievement Scores of Students of Varied Abilities taught Biology Using Prior Knowledge of Behavioural Objectives Strategy.

Ability Group		Pre BAT	Post BAT	Mean Gain
High Ability	Mean	44.7000	67.2500	22.55
	N	40	40	
	Std. Deviation	9.68795	8.92634	
Moderate Ability	Mean	36.5526	55.8684	19.32
	N	38	38	
	Std. Deviation	10.37069	12.92216	

Ability Group		Pre BAT	Post BAT	Mean Gain
Low Ability	Mean	43.4444	61.9444	18.50
	N	18	18	
	Std. Deviation	11.59727	11.52221	

The analysis of data on Table 3 shows the mean achievement scores of students of varied abilities taught cellular respiration and excretory system using prior knowledge of behavioural objectives strategy. Results in Table 3 shows that the mean achievement scores of high ability students is 47.70 with a standard deviation of 9.69 during pre-test and 67.25 with a standard deviation of 8.93 in posttest. The mean achievement scores of moderate ability students is 36.55 with a standard deviation of 10.37 during pre-test and 55.87 with a standard deviation of 12.92 in posttest. The mean achievement scores of is 43.44 with a standard deviation of 11.59 during pre-test and 61.94 with a standard deviation of 11.52 in posttest. The table further shows that the mean gain for high ability is 21.88, while that of moderate ability is 13.48 and low ability is 13.44. The summary of the mean gain in achievement score of students of high, moderate and low abilities taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives strategy is as shown in Fig. 3.

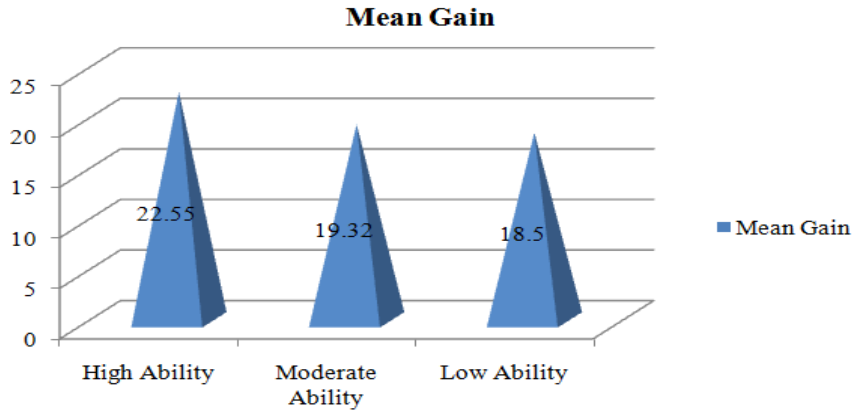

Fig. 3. Mean gain in achievement of students of varied abilities taught Biology using assertive questioning strategy.

IX. Research Question Four

What is the mean achievement score of male and female students taught cellular respiration and excretory system in biology using assertive questioning strategy?

Table 4. Mean Achievement Score of Male and Female Students taught Cellular Respiration and Excretory System in Biology Using Assertive Questioning Strategy.

Gender		Pre BAT	Post BAT	Mean Gain
Male	Mean	40.9762	57.0714	16.10
	N	42	42	
	Std. Deviation	10.98444	12.38093	
Female	Mean	42.3095	58.3571	16.05
	N	42	42	
	Std. Deviation	12.07999	12.66803	

Gender		Pre BAT	Post BAT	Mean Gain
Mean difference				0.05

Table 4 shows the difference in the mean achievement score of male and female students taught cellular respiration and excretory system in biology using assertive questioning strategy. The table shows that the mean achievement scores of male students is 40.98 with a standard deviation of 10.98 during pre-test and 57.07 with a standard deviation of 12.38 in posttest. While the mean achievement scores of female students is 42.31 with a standard deviation of 12.08 during pre-test and 58.36 with a standard deviation of 12.67 in posttest, Table 7 further shows that the mean gain of male students that were taught cellular respiration and excretory system in biology using assertive questioning strategy is 16.10 and those of female students taught cellular respiration and excretory system in biology using assertive questioning strategy is 16.05. The difference between the mean gains of male and female students taught cellular respiration and excretory system in biology using assertive questioning strategy is 0.05 in favour of male students.

X. RESEARCH QUESTION FIVE

What is the mean achievement score of male and female students taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives strategy?

Table 5. Mean achievement score of male and female students taught cellular respiration and excretory system in Biology using Prior knowledge of behavioural objectives strategy.

Gender		Pre BAT	Post BAT	Mean Gain
Male	Mean	40.0571	62.6286	22.57
	N	35	35	
	Std. Deviation	10.34392	10.01788	
Female	Mean	41.9180	61.2459	19.33
	N	61	61	
	Std. Deviation	11.26395	13.29994	
Mean difference				3.24

Table 5 shows the difference in the mean achievement score of male and female students taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives strategy. The result shows that the mean achievement scores of male students taught cellular respiration and excretory system using prior knowledge of behavioural objectives strategy is 40.06 with a standard deviation of 10.34 during pre-test and 62.63 with a standard deviation of 10.02 in posttest. The mean achievement scores of female students taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives strategy is 41.92 with a standard deviation of 11.26 during pre-test and 61.25 with a standard deviation of 13.30 in posttest, Table 8 further shows that the mean gain of male students that were taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives strategy is 22.57 and those of female students taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives strategy is 19.33. The difference between the mean gains of male and female students taught cellular

respiration and excretory system in biology using prior knowledge of behavioural objectives strategy is 3.24 in favour of male students.

XI. HYPOTHESIS ONE

There is no significant difference in the mean achievement scores of students taught cellular respiration and excretory system in biology using assertive questioning strategy, prior knowledge of behavioural objectives strategy and lecture method.

Table 6. ANCOVA of mean achievement scores of students taught Biology using assertive questioning strategy, Prior knowledge of behavioural objectives strategy and lecture method.

Dependent Variable: POSTBAT						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	16192.477[a]	3	5397.492	45.260	.000	.342
Intercept	18438.807	1	18438.807	154.617	.000	.372
PREBAT	12134.619	1	12134.619	101.754	.000	.281
Group	4506.653	2	2253.326	18.895	.000	.126
Error	31125.433	261	119.255			
Total	924567.000	265				
Corrected Total	47317.909	264				

a. R Squared = .342 (Adjusted R Squared = .335)

Table 5 reveals that F (2,264) = 18.895; p = 0.000 < 0.05. Thus, the null hypothesis is rejected. This implies that there is significant difference in the mean achievement scores of students taught cellular respiration and excretory system in biology using assertive questioning strategy, prior knowledge of behavioural objectives strategy and lecture method. Thus, it can be concluded that based on evidence from data analysis there is significant difference in the mean achievement scores of students taught cellular respiration and excretory system in biology using assertive questioning strategy, prior knowledge of behavioural objectives strategy and lecture method classes. The partial Eta square of 0.126 was obtained for the strategy meaning that only 12.6% of the Biology students' mean achievement scores can be accounted for by the strategies employed in the teaching.

Table 7. Comparisons of mean achievement scores of students taught Biology using assertive questioning strategy, Prior knowledge of behavioural objectives strategy and lecture method.

(I) GROUP	**(J) GROUP**	**Mean Difference (I-J)**	**Std. Error**	**Sig.[b]**
Assertive Questioning Instructional Strategy	Prior Knowledge of Behavioural Objectives Strategy	-4.303*	1.632	.009
	Lecture Method	5.690*	1.681	.001
Prior Knowledge of Behavioural Objectives Strategy				
	Lecture Method	9.993*	1.627	.000

*Means the value is significant at 0.05 alpha level.

Table 7 shows the bivariate comparisons of the methods of teaching cellular respiration and excretory system in biology and its effect on the mean achievement scores of students at P = 0.009 < 0.05 for assertive questioning strategy and prior knowledge of behavioural objectives strategy. Again, comparisons of the methods of teaching cellular respiration and excretory system in biology and its effect on the mean achievement scores of students at P = 0.001< 0.05 for assertive questioning strategy and lecture method. Similarly, comparisons of the methods of teaching cellular respiration and excretory system in biology and its effect on the mean achievement scores of students at P = 0.000 < 0.05 for prior knowledge of behavioural objectives strategy and lecture method. This implies that there is significant difference among all pairs in the mean achievement scores of students taught cellular respiration and excretory system in biology using assertive questioning strategy, prior knowledge of behavioural objectives strategy and lecture method.

XII. HYPOTHESIS TWO

There is no significant difference among the mean achievement scores of students of varied abilities taught cellular respiration and excretory system in biology using assertive questioning strategy.

Table 8. ANCOVA of mean achievement of students of varied abilities taught Biology using assertive questioning strategy.

Dependent Variable: Post BAT						
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	7478.758[a]	3	2492.919	36.793	.000	.580
Intercept	7047.492	1	7047.492	104.015	.000	.565
Pre BAT	2421.644	1	2421.644	35.741	.000	.309
Ability Group	2466.237	2	1233.119	18.200	.000	.313
Error	5420.385	80	67.755			
Total	292698.000	84				
Corrected Total	12899.143	83				

a. R Squared = .580 (Adjusted R Squared = .564)

Table 8 reveals that F (2, 83) = 18.200; p = 0.000 < 0.05. Thus, the null hypothesis is rejected. This implies that there is significant difference among the mean achievement scores of students of varied abilities taught cellular respiration and excretory system in biology using assertive questioning strategy. Thus, it can be concluded that based on evidence from data analysis there is significant difference among the mean achievement scores of students of varied abilities taught cellular respiration and excretory system in biology using assertive questioning strategy. The partial Eta square of 0.313 was obtained for the strategy meaning that only 31.3% of the students' achievement can be attributed to assertive questioning strategy.

Table 9. Comparisons of mean achievement of students of varied abilities taught Biology using assertive questioning strategy.

(I) Ability Group	(J) Ability Group	Mean Difference (I-J)	Std. Error	Sig.[b]
High Ability	Moderate Ability	11.435*	2.136	.000
	Low Ability	14.116*	2.702	.000

(I) Ability Group	(J) Ability Group	Mean Difference (I-J)	Std. Error	Sig.[b]
Moderate Ability				
	Low Ability	2.681	2.379	.263

*Means the value is significant at 0.001 alpha level.

Table 9 shows the bivariate comparisons of the ability levels and its effect on the mean achievement scores of students at P = 0.000< 0.05 for high ability and moderate ability. Again, comparisons of ability levels and its effect on the mean achievement scores of students at P = 0.000 < 0.05 for high ability and low ability. Similarly, comparisons of ability levels and its effect on the mean achievement scores of students at P = 0.263 > 0.05 for moderate ability and low ability student. The null hypothesis is therefore rejected. Thus, the rejected null hypothesis is confirmed and upheld. This implies that there is significant is significant difference among the mean achievement of high and other ability students but no significant difference between moderate and low ability student taught cellular respiration and excretory system in biology using assertive questioning strategy.

Hypothesis Three

There is no significant difference between the mean achievement scores of students of varied abilities taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives strategy.

Table 10. ANCOVA of mean achievement of students of varied abilities taught Biology using prior knowledge of behavioural objectives strategy.

Dependent Variable: Post BAT						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	6887.302[a]	3	2295.767	29.414	.000	.490
Intercept	6266.267	1	6266.267	80.284	.000	.466
Pre BAT	4362.088	1	4362.088	55.888	.000	.378
Ability Group	663.027	2	331.513	4.247	.017	.085
Error	7180.698	92	78.051			
Total	380122.000	96				
Corrected Total	14068.000	95				

a. R Squared = .490 (Adjusted R Squared = .473)

Table 10 reveals that F (2, 95) = 18.895; p = 0.017< 0.05. Thus, the null hypothesis is rejected. This implies that there is significant difference between the mean achievement score of students of varied abilities taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives strategy. Thus, it can be concluded that based on evidence from data analysis there is significant difference between the mean achievement score of students of varied abilities taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives strategy. The partial Eta square of 0.085 was obtained for the strategy meaning that only 8.5% of the students' mean achievement scores can be accounted for by prior knowledge of behavioural objectives strategy.

Table 11. Comparisons of mean achievement of students of varied abilities taught Biology using prior knowledge of behavioural objectives strategy.

(I) Ability Group	(J) Ability Group	Mean Difference (I-J)	Std. Error	Sig.[b]
High Ability	Moderate Ability	5.981*	2.128	.006
	Low Ability	4.473	2.510	.078
Moderate Ability				
	Low Ability	-1.507	2.601	.564

*Means the value is significant at 0.05 alpha level.

Table 11 shows the bivariate comparisons of the ability levels and its effect on the mean achievement of students at P = 0.006 < 0.05 for high ability and moderate ability. Again, comparisons of ability levels and its effect on the mean interest of students at P = 0.078 > 0.05 for high ability and low ability. Similarly, comparisons of ability levels and its effect on the mean achievement scores of students at P = 0.564 > 0.05 for moderate ability and low ability student. The null hypothesis is therefore rejected for mean difference between high and moderate abilities but not rejected for differences between high and low as well as between moderate and low abilities. Thus, the significant difference is confirmed and upheld for high and moderate ability only. This also implies no significant difference among the mean achievement of students of other abilities taught cellular respiration and excretory system in biology using assertive questioning strategy.

XIII. HYPOTHESIS FOUR

There is no significant difference between the mean achievement scores of male and female students taught cellular respiration and excretory system in biology using assertive questioning strategy.

Table 12. ANCOVA of mean achievement scores of male and female students taught Biology using assertive questioning strategy.

Dependent Variable: Post BAT						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	5015.633[a]	2	2507.817	25.767	.000	.389
Intercept	5137.788	1	5137.788	52.789	.000	.395
Pre BAT	4980.919	1	4980.919	51.177	.000	.387
Gender	3.112	1	3.112	.032	.859	.000
Error	7883.510	81	97.327			
Total	292698.000	84				
Corrected Total	12899.143	83				

a. R Squared = .389 (Adjusted R Squared = .374)

Table 12 reveals that F (1. 83) = 0.032; p = 0.859 > 0.05. Thus, the null hypothesis is not rejected. This implies that there is no significant difference between the mean achievement scores of male and female students taught cellular respiration and excretory system in biology using assertive questioning strategy. Thus, it can be

concluded that based on evidence from data analysis that no significant difference exist between the mean achievement scores of male and female students taught cellular respiration and excretory system in biology using assertive questioning strategy. The partial Eta square of 0.000 was obtained for the strategy and this implies that no percentage of the students' achievement can be accounted for by assertive questioning strategy.

XIV. HYPOTHESIS FIVE

There is no significant difference between the mean achievement scores of male and female students taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives strategy.

Table 13. ANCOVA of mean achievement scores of male and female students taught Biology using prior knowledge of behavioural objectives strategy.

Dependent Variable: Post BAT						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	6395.106[a]	2	3197.553	38.756	.000	.455
Intercept	6038.393	1	6038.393	73.189	.000	.440
Pre BAT	6352.589	1	6352.589	76.997	.000	.453
Gender	170.831	1	170.831	2.071	.154	.022
Error	7672.894	93	82.504			
Total	380122.000	96				
Corrected Total	14068.000	95				

a. R Squared = .455 (Adjusted R Squared = .443)

Table 13 reveals that F (1.95) = 2.071; p = 0.154 > 0.05. Thus, the null hypothesis is not rejected. This implies that there is no significant difference between the mean achievement scores of male and female students taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives strategy. Thus, it can be concluded that based on evidence from data analysis that no significant difference exists between the mean achievement scores of male and female students taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives strategy. The partial Eta square of 0.022 was obtained for the strategy meaning that only 2.2% of the students' achievement can be accounted for by prior knowledge of behavioural objectives strategy.

Discussion of Findings

The findings revealed that there is significant difference in the mean achievement scores of students taught cellular respiration and excretory system in biology using assertive questioning strategy, prior knowledge of behavioural objectives strategy and lecture method. The bivariate comparisons of the methods of teaching cellular respiration and excretory system in biology and its effect on the mean achievement scores of students confirmed the rejected hypothesis with difference in mean score between any pair of the students from the three strategies was significant. This means that biology could be better taught using assertive questioning strategy and prior knowledge of behavioural objectives strategy than lecture method. The findings agree with that of [26] who found that students who were shown the objectives before the lesson performed better than those that were not shown objectives before the lesson. The study also found that the best time to show learners the lesson

objectives is immediately before the lesson starts. The findings also agree with that of [22] that the experimental group that had prior knowledge of the lesson objectives significantly performed better in mathematics academic performances test than the control group. This implies that the use of behavioural objective-based instructional strategy should be encouraged in teaching and learning process in order to enhance students' academic achievement in biology.

The findings also agree with that of [2] that students in urban school location obtained significantly higher scores in biology than the students in the rural school location due the use of prior knowledge of instructional objectives. The findings also agree with that of [11] that students taught with prior knowledge of behavioural objectives method had significantly higher academic achievement than their counterparts exposed to lecture method in Chemistry. The findings also agree with that of [3] that there was a significant difference in the mean achievement and mean retention in favour of the students in the experimental group exposed to study questions advance organizers and inquiry method.

The main advantages of assertive questioning and prior knowledge instructional strategies when compared with lecture method is that it involves the students, and so ensures concentration and provides the teacher with feedback which is responsible for the significant difference in the mean achievement scores of students. Similarly, prior knowledge instructional strategy provides the statements that define the expected goals of a curriculum, course, lesson or activity in terms of demonstrable skills or knowledge that will be acquired by students as a result of instruction.

Findings also revealed that there is significant difference among the mean achievement of students of varied abilities taught cellular respiration and excretory system in biology using assertive questioning strategy. The bivariate comparisons of the ability levels and its effect on the mean achievement scores of students confirmed the rejected null hypothesis, that is, the difference between mean scores of any pair of students in the three categories of ability was significant. This implies that the use of assertive questioning strategy facilitated the achievement of students of different abilities. The findings agree with that of [15] that in all categories of students (deep and surface learners), cueing questions used as scaffolds led to improved achievement in biology.

The use of assertive questioning strategy encourages the teacher to ask for an answer from students in biology class evenly; the teacher nominates the person who will answer. The teacher used assertive questioning strategy to get at least half of the answers from the low ability students in the class and spreads the answers out to the class as much as possible. The teacher asks the students to explain their answers to the class and asks for some other opinions from the students; yet, the teacher does not give away the answer because if a correct answer is given away too early, the essence of the strategy to involve the students in thinking will be defeated. This possibly was responsible for the significant difference found in the present study.

The findings on the use of prior knowledge of behavioural objectives strategy and ability levels revealed that there is significant difference between the mean achievement of students of varied abilities taught cellular respiration and excretory system in biology using prior knowledge of behavioural objectives strategy. The bivariate comparisons of the ability levels and its effect on the mean achievement scores of students confirmed the rejected of null hypothesis. This implies that the use of prior knowledge of behavioural objectives strategy is sensitive to the achievement of students of different abilities. The findings agree with that of [4] that the achieve -ment scores of the experimental group within the higher level and medium to low level was insignificant.

Prior knowledge of behavioural objectives strategy is a plausible strategy largely because a teacher uses it when he/she wants the students to be the centre of attention in the learning process. In the current study the teacher uses it appropriately, the students' need were met on individual basis which is responsible for the significant difference between the mean achievement of students of varied abilities taught cellular respiration and excretory system in biology.

The finding on the use of assertive questioning strategy and gender revealed that there is no significant difference between the mean achievement scores of male and female students taught cellular respiration and excretory system in biology. This implies that the use of assertive questioning strategy is not gender sensitive based on the mean achievement scores of students. However, the findings run contrary to that of [4] that significant difference exists in the achievement level between male and their female counterparts. The findings also disagree with that of [18] that mean achievement score of female was higher than mean achievement score of the male students. Similarly, finding on the use of prior knowledge of behavioural objectives strategy and gender revealed that there is no significant difference between the mean achievement scores of male and female students taught cellular respiration and excretory system in biology. This implies that the use of prior knowledge of behavioural objectives strategy is not gender sensitive based on the mean achievement scores of students. The findings agree with that of [9] that gender has no significant influence on achievement of integrated science students exposed to prior objectives before actual lessons.

XV. CONCLUSION

It is evident from the findings of this study that the use of assertive questioning strategy and prior knowledge of behavioural objectives strategy enhanced students' achievement in Biology and also improves students' learning abilities. These strategies are efficacious, learner-oriented and allow active participation than the method which is passive and teacher-centered. The effect of these teaching strategies is not dependent on gender. Achievement in Biology is a function of method rather than gender. Both sexes are capable of competing and collaborating in classroom activities. Since students' achievement and learning abilities of learnt materials are the main thrust of teaching Biology, greater attention needs to be paid to the use of assertive questioning strategy and prior knowledge of behavioural objectives strategy as teaching approaches.

The implications of the findings therefore are that assertive question and prior knowledge of behavioural objectives strategies enhanced students' achievement, problem solving ability in Biology as a subject. It was concluded that assertive questioning strategy and prior knowledge of behavioral objectives strategy was beneficial to both male and female students.

XVI. RECOMMENDATIONS

It was recommended that teachers of Biology should use assertive questioning strategy and prior knowledge of behavioural objectives strategy to improve the academic achievement, learning abilities and interest of their students in Biology. Also, Biology teacher-trainees should be trained on the use of the assertive questioning strategy and prior knowledge of behavioural objectives strategy.

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