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Impact of Biology Practical Activities on the Academic Performance of Secondary School Students in Port Harcourt City Local Government Area.

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ABSTRACT*: The study examines impact of biology practical activities on the academic performance of secondary school students in Port Harcourt City Local Government Area. Four research questions and four null hypotheses formulated guided the study. The study adopted the descriptive survey research design. The population of the study consisted of all the students of public senior secondary schools in Port Harcourt City local government area of Rivers State. The sample size of 390 students was determined using Taro Yamane formula. The sample size comprised of 217 male and 173 female students. A Self- structured instrument titled "Impact of biology practical activities on Academic Performance Questionnaire" was used for data collection. Mean and standard deviation was used to analyze the research question while z-test analysis was used to test the hypothesis at 0.05 level of significance. The instrument was face and content validated by experts and average reliability coefficient 0.81 with Cronbach Alpha coefficient method was obtained. Results from the study shows that practical activities in biology plays a significant role in the overall academic performance of students in secondary schools in Port Harcourt Local Government Area. It was recommended among others that practical activities approach should be utilized and made mandatory in the teaching and learning in schools and that government should build and equip all laboratories in all the secondary schools to facilitate learning.*

Keywords: Genetics experiment, Antibiotic Resistance Experiments, Dissection experiment, Academic Performance

Introduction

Science is a systematic process of obtaining verifiable and testable knowledge about nature through theoretical and practical activities. Aniodoh (2018), viewed science as a body of knowledge arrived at through systematic and procedural processes based on tentative observation and experiment. Science may be viewed as a way of thinking in the pursuit of understanding nature, a way of investigating and a body of established knowledge, science as a product as well as a process. Ambuonu, Opuli and Eze (2015), noted that without science the world today would not have been what it is. Technological advancement has completely changed the world into a global village with the advancement and the development in communication, agricultures and building etc. Science according to Attiji (2018) is a dynamic human activity concerned with understanding of the working of our world. Ali (2010) stated that the word science stands for a variety of information, abilities and operations about the natural environment. As also stated, that science is more concerned with various investigative processes and activities with regards to developing, acquiring and controlling knowledge, skills, acceptability and attitudes about the natural factors of the environment. Science is an intellectual activity through which many seek to understand nature. According to Kolani (2015), science is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe. Science is typically divided into the natural science which studies the natural world, the social science which study people and society and the formal science such as mathematics. From classical antiquity through the 19th century, science as a type of knowledge was closely linked to philosophy. Biology according to Sarojini (2015) is the branch of science that includes the study of living things. It is a natural science concerned with study of life and living organisms including the structures, functions, growth, evolution, distribution, identification and taxonomy. It is also a natural science concerned with the study of living things in our environment. Biology is the apiculture of all studies in faculties of science education, health, pure or applied science. It is an important subject for most students in secondary schools in Nigeria for admission into tertiary institutions.

Development in science over the years have influenced and dominated every aspect of human endeavor such that any individual lacking in scientific literacy find it very hard to survive in the contemporary society. For any nation to attain this rapid scientific growth and advancement, it is important that such a nation improve the standard of her educational system by setting up science laboratories in schools as a prime component of a school science programme because science has globally become a basis of an increasing workforce such that all students need a strong exposure to science (Biology) practical activities. In order for the students to achieve their career objectives, hands-on practical aspect of learning should

be mandatory for all students and the proper place for this practical aspect of learning in any science subject is in the laboratory and biology being one of the science subjects cannot be taught or learnt effectively in the absence of practical activities. It is based on this that the researcher examines the impact of biology practical activities on the academic performance of senior secondary school students in Port Harcourt City Local Government Area, Rivers State.

Teaching is said to be effective when resources such as laboratory practical activities, diagrams, charts, models, field works and real objects are efficiently utilized to explain the subject matter Nwagbo (2016). Practical activities in Biology are essentially important for concretizing theoretical classroom learning experiences and stimulating the students urge to study Biology. It also provides opportunity for students to interact with materials and ideas, and by so doing, stimulate the development of affective and psychomotor dimensions of learning alongside with the cognitive dimension in order to ensure an all-round and comprehensive development of the student Agbowuro (2006). Experimental activities in Biology could be seen as a method that could be adopted to make the task of teaching Biology more concrete or real to students as opposed to theoretical or abstract presentation of principles, facts and concepts. Experimental activities in Biology are important to students' academic performance because, it is a teaching method that has to do with practical demonstration of scientific concepts, principles, theories and laws. From its experimental engagement, the students ultimately gain capacity to acquire new facts, develop concepts and principles and skills, which lead to the cultivation of scientific attitudes and habits Onyegegbu (2006). For instance, practical activity on the influence of carbon (iv) oxide on photosynthesis, offer students the opportunity of collecting relevant data and conceptualizing on the appropriateness of the theories associated with photosynthesis and carbon (iv) oxide. It is in view of the above that, Nwagbo (2016) stated that "the used of practical activities approach to the teaching and learning of Biology concepts should therefore be made mandatory other than an option to Biology teachers, if we hope to produce students that would be able to acquire the necessary knowledge, skills and competence needed to meet the demands of the nation". This implies that, the academic performance of students in any science-based subject like Biology is closely related to both theoretical and practical knowledge. Alison (2013) said that, Biology is centered on problem solving and laboratory is the most convenient place for careful observations, accurate calculations and logical inferences, therefore, practical activities should be regarded as the main instructional procedures in which cause and effect of any concept is determined. Rughill (2011) in his study on laboratory investigative approach for a successful teaching methodology for high school science instruction, revealed that, students showed significant high grade for this cognitive dimension. Ajevalemi (2011) blame the state of student's poor performance in Biology on lack of laboratories facilities.

Enquiry based practical according to Oludipe & Oludipe (2010) offers students a more realistic experience where the answer is not always predetermined and which requires students to come up with their own ideas from their own observation. Students who avoid practical classes are always frightened by figures of graph during examinations and this made them not to understand the figures for correct interpretations. Eze and Ezemagu (2018) observed that schools which are involved in practical classes perform better in SSCE than those that neglect practical work. As disclosed by Sandberg (2015), educators were initially slow to change their methodologies in biology but with good result (improved academic performance) and support from national science and educational organizations, there is now progress (Myer and Burgess 2003). From the above, it can be stated categorically that biology practical has a positive effect on the academic performance of students in biology examinations.

Statement of the Problem

Biology which serves as a prerequisite at A-level for studying some disciplines such as Medicine, Pharmacy, Agriculture, Food Technology, equips individuals with diverse information about the basic principles of life and natural laws influencing living things. The teaching of Biology in secondary schools needs to be more practical oriented in order to enhance students' achievement in the subject. It is unfortunate that the practical lessons have suffered neglects in the subject in Port Harcourt Local Government Area of Rivers State as observed by the researcher during her teaching practice period with inadequate materials and facilities, Insufficient qualified teachers and large class size to carry out practical which affect the overall achievement of students in Biology based on results from external examinations.

Salami, Isah, Dayil (2023); Nwagbo, (2016) established that resources such as diagrams, field works and models mockups, when effectively used to explain the subject matter very well is better than mere lecture. The proper place for effective practical activities is the laboratory. Biology being one of the science subjects cannot be taught or learnt effectively in the absence of practical activities. Practical activities help students to understand and assimilate what is being taught which by extension improve their performancein the subject. In spite of efforts through research to improve performance of students in Biology, the teaching and learning of Biology have continually received lots of criticism from the society sequel to students' poor performance in Biology external examinations. Biology chief examiners reports have in recent years, indicated a decline in candidates' performance in external examinations and this weakness was attributed to students' inability to understand some Biology concepts due to inadequate exposure to practical work. To this end, this study seeks to determine the impact of Biology practical activities on the academic performance of secondary school students in Port Harcourt City Local Government Area.

Purpose of the Study

The main purpose of this study was to investigate the impact of Biology Practical Activities on the academic performance of secondary school students in Port Harcourt City Local Government Area. This study, however, aims to achieve the following specific objectives:

1. To examine the impact of observation of microorganisms using microscopes on the academic performance of senior secondary school students in Port Harcourt City Local Government Area.
2. To examine the impact of dissection of specimen on the academic performance of senior secondary school students in Port Harcourt City Local Government Area.
3. To examine the impact of bacteria growth and antibiotic resistance experimental activities on the academic performance of senior secondary school students in Port Harcourt City Local Government Area.
4. To examine the impact of genetics experimental activities on the academic performance of senior secondary school students in Port Harcourt City Local Government Area.

Research Questions

The following research questions guided the study:

1. To what extent does observation of microorganisms using microscopes impact the academic performance of senior secondary school students in Port Harcourt City Local Government Area?
2. To what extent does dissection of specimen impact the academic performance of senior secondary school students in Port Harcourt City Local Government Area?
3. To what extent does bacteria growth and antibiotic resistance experimental activitiesimpact the academic performance of senior secondary school students in Port Harcourt City Local Government Area?
4. To what extent does genetics experimental activities impactthe academic performance of senior secondary school students in Port Harcourt City Local Government Area?

Hypotheses

The following null hypotheses were formulated to guide the study

1. There is no significant difference in the mean ratings of male and female student's responses on the extent to which observation of microorganisms using microscopeimpacts the academic performance of senior secondary school students in Port Harcourt City Local Government Area.
2. There is no significant difference in the mean ratings of male and female student's responses on the extent to which dissection of specimen impacts the academic performance of senior secondary school students in Port Harcourt City Local Government Area.
3. There is no significant difference in the mean ratings of male and female student's responses on the extent to which bacteria growth and antibiotic resistance experimental activities impacts the academic performance of senior secondary school students in Port Harcourt City Local Government Area.
4. There is no significant difference in the mean ratings of male and female student's responses on the extent to which genetics experimental activities impacts the academic performance of senior secondary school students in Port Harcourt City Local Government Area.

Significance of the Study

The findings of this study would be of immense benefit to the students, teachers, parents, curriculum planners, federal

government and the nation or general public at large.
It will also help the students acquire basic scientific skills and improve their performance and achievement as well. The study would enable students to see the need to utilize every practical session to enhance their understanding and arouse their interest in practical work.
This study would provide a basis for decision making among teachers, on the effective teaching methods to be adopted in Nigerian educational system to make science teaching more meaningful and interesting to the students.

Methodology

This study adopted descriptive survey research design. The descriptive survey research design was appropriate because this study was aimed at examining the impact of biology practical activities on the academic performance of senior secondary school students in Port Harcourt City Local Government Area.
This study was conducted in Port Harcourt City local government area of Rivers State. It is one of the 23 local government areas created for the state. The target population of the study consists of all the 15,702 male and female students of Public senior secondary school students in Port Harcourt City local government area of Rivers State (Rivers State Senior Secondary Education Board, 2022). Taro Yamane formular was used to determine the sample size of 390 students. Simple random sampling method was used to select 10 Secondary schools from where 390 students (217 female and 173 male) were selected.

The research instrument that was used for data collection was a self-structured instrument titled Impact of Biology Practical Activities on Academic Performance Questionnaire (IBPAAPQ). The instrument which was faced and content validated by two research experts is prepared on a 4-point rating scale ranging from Very High Extent (VHE) = 4, High Extent (HE) = 3, Low Extent (LE) = 2 and Very Low Extent (LE) = 1. The Cronbach alpha reliability test was used to determine the internal consistency of the instrument which yielded an overall value of 0.81 and was therefore considered adequate for the study. The instrument was administered by the researcher with the aid of 10 research assistant, one from each of the 10 secondary school used for the research. In total, 390 copies of the questionnaire were given out of which only 320 were retrieved and correctly completed. The number that was retrieved and correctly completed comprised of 141 male students and 179 female students.

This number was therefore used for data analysis. The data collected was analyzed using mean and standard deviation to answer the research questions. A criterion mean score of 2.5 was used to ascertain the acceptance or rejection of each item in the questionnaire. Any score less than 2.50 was regarded as disagree while scores of 2.50 and above was regarded as Agree. The null hypotheses formulated was tested at 0.05 level of significance using z-test statistics. The decision rule is to accept a null hypothesis where the calculated z –value (+1.96) is less than the critical z-tabulated contrarily the null hypothesis was rejected where the calculated z-value is greater than critical z-tabulated of ± 1.96.

Results

Research Question 1: To what extent does observation of microorganisms using microscopes impacts the academic performance of senior secondary school students in Port Harcourt City Local Government Area?

Table 1: Mean and Standard Deviation on the extent to which observation of microorganisms using microscopes impacts the academic performance of senior secondary school students in Port Harcourt City Local Government Area.

S/N	Questionnaire item	Male 141			Female 179			Average		
		$\overline{X}$	SD		$\overline{X}$	SD		$\overline{X}$	SD	
1	Microscope observation provides students with hands-on learning experiences, which can enhance their understanding of biological concepts.	2.75	1.15	HE	2.89	1.01	HE	2.82	1.08	HE
2	Visual aids such as microscopes help students visualize abstract concepts, making it easier for them to grasp complex biological structures and processes.	2.93	1.12	HE	3.08	1.00	HE	3.01	1.06	HE
3	Analyzing microorganisms under a microscope requires students to engage in critical thinking and problem-solving.	2.89	1.14	HE	3.29	0.84	HE	3.09	0.99	HE
4	Microscope observation improves student's observational skills in other areas of study.	3.08	0.84	HE	3.37	0.79	HE	3.23	0.82	HE
5	Hands-on activities like microscope observation can increase student motivation and engagement in science classes.	2.99	1.01	HE	3.22	0.83	HE	3.11	0.92	HE
	Grand mean	**2.93**			**3.17**			**2.96**		

Source: Field Survey 2024

Table 1 examined the extent to which observation of microorganisms using microscopes impacts the academic performance of senior secondary school students in Port Harcourt City Local Government Area. Results in Table 1 revealed that both male and female students of senior secondary schools in Port Harcourt City Local Government Area agreed to a high extent to most of the items. They agreed that microscope observation provides students with hands-on learning experiences, which can enhance their understanding of biological concepts, that visual aids such as microscopes help students visualize abstract concepts, making it easier for them to grasp complex biological structures and processes., that analyzing microorganisms under a microscope requires students to engage in critical thinking and problem-solving, that microscope observation improves student's observational skills in other areas of study and that hands-on activities like microscope observation can increase student motivation and engagement in science classes. With a mean average of 2.96 greater than the criterion means of 2.50 implies that both male and female students agreed to a high extent that observation of microorganisms using microscopes impacts the academic performance of senior secondary school students in Port Harcourt City Local Government Area.

Research Question 2: To what extent does engaging in dissection of specimen impacts the academic performance of senior secondary school students in Port Harcourt City Local Government Area?

Table 2: Mean and Standard Deviation on the extent to which engaging in the dissection of specimens' impacts the academic performance of senior secondary school students in Port Harcourt City Local Government Area.

S/N	Questionnaire item	Male 141			Female 179			Average		
		$\bar{X}$	SD		$\bar{X}$	SD		$\bar{X}$	SD	
1	Engaging in the dissection of specimenshelps to simplify complex concepts in biology for easy understanding.	**2.75**	**1.15**	VHE	2.69	1.18	VHE	2.72	1.17	VHE
2	Engaging in the dissection of specimenscreates virtual pictures of solutions on the minds of the students	**2.92**	**1.12**	HE	3.22	0.92	HE	3.07	1.02	HE
3	Engaging in the dissection of specimenscreates room for deliberations on concepts for clarity and easy retention.	**2.87**	**1.14**	VHE	3.11	1.03	VHE	2.99	1.09	VHE
4	Engaging in the dissection of specimenspromote long- term memory that theory alone cannot do.									
5	Engaging in the dissection of specimenshelps to develop student's cognitive ability to understand concepts.	**3.08**	**0.95**	VHE	3.01	1.11	VHE	3.05	1.03	VHE
		2.99	**1.13**	HE	3.05	1.08	VHE	3.02	1.11	HE

Grand mean	**2.92**	**3.02**	**2.97**

Source: Field Survey 2024

Table 2 examined the extent to which engaging in the dissection of specimens improve the academic performance of senior secondary school students in Port Harcourt City Local Government Area. Results in Table 2 revealed that both male and female students of senior secondary schools in Port Harcourt City Local Government Area agreed to a high extent to all of the items. They agreed that engaging in the dissection of specimens helps to simplify complex concepts in biology to easy understanding, that engaging in the dissection of specimens creates virtual pictures of solutions on the minds of the students, that engaging in the dissection of specimens creates room for deliberations on concepts for clarity and easy retention, that engaging in the dissection of specimens promote long-term memory that theory alone cannot do and that engaging in the dissection of specimens helps to develop student's cognitive ability to understand concepts.. With a mean average of 2.97 greater than the criterion means of 2.50 implies that both male and female students agreed to a high extent that engaging in the dissection of specimens impacts the academic performance of senior secondary school students in Port Harcourt City Local Government Area.

Research Question 3: To what extent does bacteria growth and antibiotic resistance experimental activities impact the academic performance of senior secondary school students in Port Harcourt City Local Government Area?

Table 3: Mean and Standard Deviation on the extent to which bacteria growth and antibiotic resistance experimental activities impact the academic performance of senior secondary school students in Port Harcourt City Local Government Area.

S/N	Questionnaire item	Male 141			Female 179			Average	
		$\bar{X}$	SD		$\bar{X}$	SD		$\bar{X}$	SD
1	It helps students gain a deeper understanding of microbial ecology	3.30	1.01 HE	HE	**3.00**	0.95	VHE	3.15	0.98
2	It enable students to apply the scientific method in a real- world context.								
3	Students are able to gain more insights into the mechanisms of antibiotic resistance and the importance of responsible antibiotic use.	3.12	0.83 VHE	HE	**3.36**	0.78	VHE	3.24	0.94
4	It helps students see the connections between different fields of science and develop a more comprehensive understanding of complex biological phenomena.	3.05	1.01 VHE	VHE	**3.29**	0.92	VHE	3.17	0.97
5	It prepares students for future studies and careers in fields such as microbiology, medicine, pharmacology, and public health.	3.08	1.05 VHE	VHE	**3.30**	0.85	VHE	3.19	0.95
		3.11	1.09 VHE	VHE	**3.43**	0.73	VHE	3.27	0.92
	Grand mean	**3.13**			**3.28**			**3.21**	

Source: Field Survey 2024

Table 3 examined the extent to which on the extent to which bacteria growth and antibiotic resistance experimental activities impact the academic performance of senior secondary school students in Port Harcourt City Local Government Area. Results in Table 3 revealed that both male and female students of senior secondary schools in Port Harcourt City Local Government Area agreed to a very high extent to most of the items. They agreed that bacteria growth and antibiotic resistance experiments helps students gain a deeper understanding of microbial ecology, that it enable students to apply the scientific method in a real-world context, that students are able to gain more insights into the mechanisms of antibiotic resistance and the importance of responsible antibiotic use, that it helps students see the connections between different fields of science and develop a more comprehensive understanding of complex biological phenomena and that it prepares students for future studies and careers in fields such as microbiology, medicine, pharmacology, and public health. With a mean average of 3.21 greater than the criterion means of 2.50 implies that both male and female students agreed to a high extent that extent that engaging in observation of growth rate enhances predictive competencies among senior secondary school students in Port Harcourt City Local Government Area.

Research Question 4: To what extent does genetics experimental activities impact the academic performance of senior secondary school students in Port Harcourt City Local Government Area?

Table 4: Mean and Standard Deviation on the extent to which genetics experimental activities impact the academic performance of senior secondary school students in Port Harcourt City Local Government Area.

S/N	Questionnaire item	Male 141			Female 179			Average SD		
		$\bar{X}$	SD		$\bar{X}$	SD		$\bar{X}$		
1	Genetics experiments help students understand the principles of heredity and inheritance.	3.27	0.89	HE	3.39	0.70	VHE	3.33	0.80	VHE
2	It enhances their understanding and retention of genetic principles.	3.16	1.05	HE	3.21	0.92	VHE	3.19	0.99	HE
3	It allows them to analyze data, and interpret results, which fosters their analytical skills and scientific reasoning abilities.	3.08	1.00	VHE	3.53	0.67	VHE	3.31	0.84	VHE
4	Engaging in genetics experiments allows students to apply the scientific method in a real-world context.	3.15	1.04	VHE	3.31	0.97	VHE	3.23	1.01	VHE
5	By performing genetic experiments, students gain practical experience with molecular biology techniques commonly used in research laboratories.	3.16	0.90	VHE	3.48	0.78	VHE	3.32	0.84	VHE
	Grand mean SD (Average)	**3.16**	**0.98**		**3.38**	**0.81**		**3.27**	**0.90**	

Source: Field Survey 2024

Table 4 examined the extent to which genetics experimental activities impact the academic performance of senior secondary school students in Port Harcourt City Local Government Area. Results in Table 4 revealed that both male and female students of senior secondary schools in Port Harcourt City Local Government Area agreed to a very high extent to most of the items. They agreed that genetics experiments help students understand the principles of heredity and inheritance, that it enhances their understanding and retention of genetic principles, that it allows them to analyze data, and interpret results, which fosters their analytical skills and scientific reasoning abilities, that engaging in genetics experiments allows students to apply the scientific method in a real-world context and that by performing genetic experiments, students gain practical experience with molecular biology techniques commonly used in research laboratories. With a mean average of 3.29 greater than the criterion means of 2.50 implies that both male and female students agreed to a high extent that genetics experimental activities impact the academic performance of senior secondary school students in Port Harcourt City Local Government Area.

Hypothesis

H01: There is no significant difference in the mean ratings of male and female student's responses on the extent to which observation of microorganisms using microscopes impacts the academic performance of senior secondary school students in Port Harcourt City Local Government Area.

Table 5: z-test Analysis of Difference between the mean ratings of student'sresponse on the extent to which observation of microorganisms using microscopes impacts the academic performance of senior secondary school students in Port Harcourt City Local Government Area.

Group	N	$\overline{X}$	SD	Df	z-cal	z-crit	α	Remark
Male	141	2.93	1.05					
				318	1.79	±1.96	0.05	Accept null
Female	179	3.17	0.89					

Source: Field Survey 2024

The data in table 5 showed that z-calculated which is 1.79 is less than z-critical ±1.96 at 0.05 level of significance. Since the z-calculated (1.79) was less than z-critical (±1.96), the null hypothesis was therefore accepted. It was therefore concluded that there is no significant difference in the mean ratings of male and female student's responses on the extent to which observation of microorganisms using microscopes impacts the academic performance of senior secondary school students in Port Harcourt City Local Government Area.

H02: There is no significant difference in the mean ratings of male and female student's responses on the extent to which dissection of specimen impactthe academic performance of senior secondary school students in Port Harcourt City Local Government Area.

Table 6: z-test Analysis of Difference between the mean ratings of students' response on the extent to which dissection of specimen impact the academic performance of senior secondary school students in Port Harcourt City Local Government Area.

Group	N	$\overline{X}$	SD	Df	z-cal	z-crit	α	Remark
Male	141	2.92	1.10					
				318	0.67	±1.96	0.05	Accept null
Female	179	3.02	1.06					

Source: Field Survey 2024

The data in table 6 showed that z-calculated which is 0.67 is less than z-critical ±1.96 at 0.05 level of significance. Since the z-calculated (0.67) was less than z-critical (±1.96), the null hypothesis was therefore accepted. It was therefore concluded that there is no significant difference in the mean ratings of male and female student's responses on the extent to which dissection of specimen impact the academic performance of senior secondary school students in Port Harcourt City Local Government Area.

H03: There is no significant difference in the mean ratings of male and female student's responses on the extent to which bacteria growth and antibiotic resistance experimental activities impact the academic performance of senior secondary school students in Port Harcourt City Local Government Area.

Table 7: z-test Analysis of Difference between the mean ratings of students'response on the extent to which engaging in observation of growth rate enhance predictive competencies among senior secondary school students in Port Harcourt City Local Government Area.

Group	N	$\overline{X}$	SD	Df	z-cal	z-crit	α	Remark
Male	141	3.13	1.00					
				318	1.16	±1.96	0.05	Accept null
Female	179	3.28	0.85					

Source: Field Survey 2024

The data in table 7 showed that z-calculated which is 1.16 is less than z-critical ±1.96 at 0.05 level of significance. Since the z-calculated (1.16) was less than z-critical (±1.96), the null hypothesis was therefore accepted. It was therefore concluded that there is no significant difference in the mean ratings of male and female student's responses on the extent to which engaging in observation of growth rate enhance predictive competencies among senior secondary school students in Port Harcourt City Local Government Area.

H04: There is no significant difference in the mean ratings of male and female student's responses on the extent to which genetics experimental activities impact the academic performance of senior secondary school students in Port Harcourt City Local Government Area.

Table 8: z-test Analysis of Difference between the mean ratings of students'response on the extent to which genetics experimental activities impact the academic performance of senior secondary school students in Port Harcourt City Local Government Area.

Group	N	$\overline{X}$	SD	Df	z-cal	z-crit	α	Remark
Male	141	3.16	0.98					
				318	1.70	±1.96	0.05	Accept null
Female	179	3.38	0.90					

Source: Field Survey 2024

The data in table 8 showed that z-calculated which is 1.70 is less than z-critical ±1.96 at 0.05 level of significance. Since the z-calculated (1.70) was less than z-critical (±1.96), the null hypothesis was therefore accepted. It was therefore concluded that there is no significant difference in the mean ratings of male and female student's responses on the extent to which genetics experimental activities impactthe academic performance of senior secondary school students in Port Harcourt City Local Government Area

Discussion of Findings

Table 1 examined the extent to which observation of microorganisms using microscopes impact the academic performance of senior secondary school students in Port Harcourt City Local Government Area. It was agreed by the students to a high extent that microscope observation provides students with hands-on learning experiences, which can enhance their understanding of Biology concepts, that visual aids such as microscopes help students visualize abstract concepts, making it easier for them to grasp complex Biology structures and processes. This result is in corroboration with the study of Mishra and Chauhan (2016) study on the applications of microscopy in bacteriology, it was revealed that to get acquainted with the world of bacteria like small organisms, very effective and advanced technique is required. Students through the use of microscopes in studying microorganisms allows them to have hands-on learning experiences, which can enhance their understanding of Biology concepts.

Table 2 examined the extent to which engaging in the dissection of specimens improve the academic performance of senior secondary school students in Port Harcourt City Local Government Area. It was agreed by the students to a high extent that engaging in the dissection of specimens helps to simplify complex concepts in Biology to easy understanding,

that engaging in the dissection of specimens creates virtual pictures of solutions on the minds of the students and that engaging in the dissection of specimens creates room for deliberations on concepts for clarity and easy retention.
The result is in connection with that of Habbal (2009) where it was also revealed that dissection can help students to be competent in the three domains of learning, i.e., knowledge, skills, and attitude. Habbal (2009) also noted that engaging in dissection activities during practical Biology aids students understanding and integrate three- dimensional anatomic knowledge of developing practical skills, encouraging peer communication and building group dynamics.

Table 3 examined the extent to which on the extent to which bacteria growth and antibiotic resistance experimental activities impact the academic performance of senior secondary school students in Port Harcourt City Local Government Area. It was agreed by the students to a very high extent that bacteria growth and antibiotic resistance experiments helps students

gain a deeper understanding of microbial ecology, that it enable students to apply the scientific method in a real-world context, that students are able to gain more insights into the mechanisms of antibiotic resistance and the importance of responsible antibiotic use, that it helps students see the connections between different fields of science and develop a more comprehensive understanding of complex biological phenomena and that it prepares students for future studies and careers in fields such as microbiology, medicine, pharmacology, and public health. This result corresponds to that of Akinyemi, O. (2020) where it was revealed that antibiotic research has been the key to improving performance and tackling antimicrobial resistance in both human and other animals for many years and hence, when students are exposed to experiments to study bacterial growth and antibiotic resistance, it helps them experience the connections between different fields of science and also develop a more comprehensive understanding of complex Biology phenomena.

Table 4 examined the extent to which genetics experimental activities impact the academic performance of senior secondary school students in Port Harcourt City Local Government Area. It was agreed by the students to a high extent that genetics experiments help students understand the principles of heredity and inheritance, that it enhances their understanding and retention of genetic principles, that it allows them to analyze data, and interpret results, which fosters their analytical skills and scientific reasoning abilities, that engaging in genetics experiments allows students to apply the scientific method in a real-world context and that by performing genetic experiments, students gain practical experience with molecular Biology techniques commonly used in research laboratories. This findings in similar to that of Cesarini and Visscher (2017) where it was noted genetics experiments often integrate concepts from multiple scientific disciplines, including Biology, chemistry, and mathematics. Engaging in interdisciplinary learning helps students see the connections between different fields of science and develop a more comprehensive understanding of Biology phenomena.

Conclusion

The study has shown that practical activities in Biology plays a significant role in the overall academic performance of students in secondary schools in Port Harcourt Local Government Area. BiologY practical activities are interrelated and interconnected with achievement of students. These activities develop students understanding of Biology content areas, their procedure, execution, observation and interpretations resulting to students improved academic achievement and performance. As competence in practical enables students to become creative and developed ability to solve problems, it then becomes necessary for Biology teachers to guide students to construct knowledge in practical activities which in turns enable them to effectively and competently tackle questions in any Biology examination to emerge successful and reliable in the field of Biology sciences. It can also be noted that where there are well- equip laboratories and teachers takes practical activities as their main instructional procedures, the students are expected to perform better.

Recommendations

Based on the findings of the study and the conclusion reached, the following recommendations were made:

1. The use of practical activities approach to the teaching and learning of Biology should be made mandatory to all Biology teachers.
2. Government should build and equip all laboratories in all the secondary schools to facilitate learning.

3. Teachers should adopt student–centered practical activity method of teaching biology as student learn better when they are involved in activity – based learning.
4. Biology teachers should be made by State Government to upgrade their education, knowledge on practical activities involved in Biology through in-service programme, availing themselves in workshops, seminars so they could overcome the challenge of the 21st century.

Educational Implications

Based on the findings, the work has the following educational implications

i. Practical Biology sessions provides students the opportunity to collaborate and this makes them to learn and understand better.
ii. Practical Biology activities provide avenues for student to simplify complex Biology concepts for easy understanding and retention.
iii. Biology practical activities also help in enhancing the understanding of scientific process and also develop in them creative abilities to source for solutions independently.

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