

# The Impact of Laboratory Practical Activities on Students' Academic Performance at Queen of Peace Senior High School in The Nadowli-Kaleo District of The Upper West Region of Ghana.

Ibrahim Issah, Valentine Baalongbuoro, Stephen Afram Oware

Methodist College of Education, Akim Oda

Queen of Peace Senior High School

Methodist College of Education, Akim Oda

## Abstract

The study looked at how Form Two (2) science students' academic achievement in biology was affected by their biology practical. It was an action research study. For the study, Form Two (2) science students from Queen of Peace Senior High School were sampled. 42 students were surveyed using a Likert scale questionnaire, in addition to an interview and pre- and post-intervention test items. Descriptive statistics and the Statistical Package for Social Sciences (SPSS) were employed in the study to examine the findings. The study found that a lack of sufficient Science Resource Center equipment to support teaching and learning is to blame for students' poor performance in biology. Despite this, the school's biology teachers lacked proper training and there was no biology lab. Therefore, as a temporary fix to the issue, the study advised schools lacking the science resource centre to send students to schools with the amenities. Ghana Education Service (GES) and the Ghana Association of Science Teachers (GAST) should regularly hold in-service training workshops and courses to keep science teachers' understanding on how to plan practical lessons current. According to the report, Ghana's government should focus on providing the Science Resource Center facilities to all of the nation's schools.

## Introduction

As long as science is a field that is both a process and a product, the laboratory is where most scientific research takes place. The extent of optimal laboratory practises that will ensure that learners acquire science process skills and proficiency in science ideas depends critically on the availability of laboratory equipment, facilities, and materials. One significant area of science education that is of great significance, according to Abimbola (2001), is the availability and efficient utilisation of specialised and pertinent science equipment, facilities, and educational materials. Active practical exercises are ensured by well-equipped, well-designed, and safe school laboratories for science teaching and learning (Katcha, 2005).

Learners can develop scientific reasoning instead of rote learning when science resource materials are available and used. Another advantage is that students gain knowledge and enthusiasm for biology via the process. The accessibility of resources can also encourage science teachers to adopt a learner-centered strategy rather than the more conventional and ineffective teacher-centered strategy. Ngman-wara (2005) came to the conclusion that practical activities will give students the opportunity to learn by doing, thinking critically, picking up skills for using tools and equipment, paying attention to directions, documenting their observations and results, organising data, and drawing conclusions.

In their study on the use of lab resources, Chenwe and Chilee (2014) concluded that the majority of the easily accessible and less expensive materials, such as textbooks, chalkboards, and charts, were used to a great extent although some expensive biology lab resources, such as computers, overhead projectors, and video-taped instructions, were used to a low extent. According to Hofstein and Lunetta (2008), the laboratory has been given a central and distinctive position in science education, and science educators have claimed that using laboratory activities can have a significant positive impact on student learning. The conceptual and experimental skills of pupils can be developed by using laboratory equipment. When discussing the value of teaching resources in Kenya, Kibirige and Hodi (2013) emphasise the value of laboratories in giving students the chance to engage with science by using scientific research techniques. Equipment and resource materials must be readily available and well-organized for effective science instruction. The findings of Nweki and Onyegyegbu (2015) regarding the resources available and students' performance in Nigeria were consistent with those of Olagunju and Abiona (2008) who discovered a notable difference in the achievement scores of students taught using various instructional materials and those who were not. According to Mudulia (2012), there is a correlation between the availability of resources and students' success in science. High performing schools receive more exposure to consumables like chemicals and lab equipment than poor performing ones. According to Kibirige and Hodi (2013), students that use laboratory investigation have a better comprehension of the physical sciences.

One of the goals of biology, as one of the science topics, is to help students understand their surroundings and the purpose of science. Fortunately, senior high schools in Ghana have reported the largest enrollments in biology over the past few years. All Senior Secondary Schools teach biology as the science of life, which draws the most interest from both pupils who are interested in the sciences and those who are interested in the arts (Nwosu, 2006). These high enrollment numbers for biology suggest that the subject is well-liked among students of other sciences. However, this figure does not correspond to what students have learned in the subject since the senior secondary school (SSS) programme, one of Ghana's educational reforms, was introduced in 1987. The West African Examination Council's (WAEC) Chief Examiners' Reports have often shown that SHS students do poorly in the sciences (WAEC, 2005). More than other science courses like physics and chemistry, biology is the subject where most students fail or receive subpar grades. The Senior High School (SHS) Program, Ghana's most recent educational reform, has been in place since 2007, and the tale has not changed.

According to the Chief Examiners' Reports, more students fail biology because they do poorly on paper 2, a practical exam. The second biology exam evaluates drawing, categorization, process analysis, and biological data analytical thinking. This suggests that the pupils either weren't guided through practical work or weren't taking the job seriously. Following are some biology-related flaws that the Chief Examiners have noted during the years (2005-2015).:

- a) unable to classify organisms;
- b) unable to draw to a certain specification or size;
- c) unable to comprehend what an observable difference means;
- d) the inability to accurately spell technical words;
- e) the incorrect matching of structures and functions;
- f) the incapacity to sketch guidelines to touch the diagram's label;
- g) the taxonomy names cannot begin with a capital letter.

Obiekwe (2008) observed that the "chalk and talk" method and the greater focus on content in science instruction overlook the practical activity method, which improves teaching and learning. This disregard for and "shy-away" attitude from the activity-based teaching approach has resulted in abstraction, which decreases

student engagement and increases their propensity for rote memorization. With these drawbacks in mind, the structure of the biology practical exercises is really intriguing and merits investigation.

## Methodology

The nature of the study was an action research. Pre-test and post-test experimental research design was used. The same participants were pre-tested and post-tested to find the effect of the intervention (practical activity).

The study's methodology was action research. An experimental pre- and post-test study approach was adopted. To determine the impact of the intervention, the same subjects underwent pre- and post-testing (practical activity). Purposive sampling was the method used for the study's sample selection. Form Two Science 2 (2C) learners were chosen as the study's research subjects. There were 42 students in Form 2C overall, including 6 girls and 36 boys. The form two class was selected because it was thought that by that time, children would have engaged in some practical biology activities and would provide more consistent answers to the questions, improving the trustworthiness of the data. Tests, observations, questionnaires, and interview schedules were the main research tools used to collect data for the study.

A validation analysis was performed on the questionnaire. This was accomplished by providing my boss and my coworkers the instrument to read so they could provide their comments. Colleagues, the supervisor, and others provided suggestions and feedback that were used to enhance the instrument's face and content validity. A pilot test of the questionnaire was conducted in a Form Two Science (2C) class at Lassia Tuolu Senior High School to ascertain its reliability. A sample of 42 students were chosen for the pilot test. This was done to make it easier to spot errors and change the questions. While the data from the observation and interview sessions were studied qualitatively, the data from the questionnaire and tests were quantitatively analysed. Two (2) stages of analysis were performed on the study's findings.

The test results (pre-intervention test and post-intervention test) and questionnaire results were analysed in the first phase using means, frequencies, and percentages. On the other side, a qualitative analysis was conducted to learn about students' opinions and perceptions of the intervention's success.

## Data Presentation, Analysis And Discussion

### Questionnaire analysis for students

Item 1: Does your school have separate labs for chemistry, biology, physics, and integrated science?

The purpose of this inquiry was to learn about the laboratories that Queen of Peace Senior High School has accessible for teachers and students to use for practical activities. Additionally, it was done to determine which topic laboratories were available at the school in order to avoid participants using the labs at the same time. The information gathered is shown in Table 1.

Table1: In the school, there are separate subject laboratories.

	Frequenc y	Percent
Strongly Agreed	6	14.3
Agreed	11	26.2
Not Known	2	4.8
Disagreed	10	23.8
Strongly Disagreed	13	31.0
Total	42	100.0

According to Table 1's findings, 14.3% (6) strongly agreed, 26.2% (11), 4.8% (2) are not sure, 23.8% (10) disagreed, and 31.0% (13), severely disputed that their school had individual laboratories. These replies show that scientific electives are not being offered in a suitable learning environment at Queen of Peace Senior High School.

**Item 2: Is there equipment and chemical inventory in the scientific lab?**

This study wanted to assess whether the science centres' laboratories were stocked with the chemicals necessary for instructors and students to carry out simple practical tasks. Table 2 displays the responses to this question.

**Table 2: Responses from students on lab tools and chemicals**

Agreed	13	31.0
Not known	4	9.5
Disagreed	9	21.4
Strongly Disagreed	10	23.8
Total	42	100.0

Table 3's results show that 14.3% (6) strongly agreed, 31.0% (13) agreed, 9.5% (4) are not sure, 21.4% (9) disagreed, and 23.8% (10) strongly opposed to the claim that the lab was supplied with chemicals. These findings suggest that there were substances present in the science lab.

**Item 3: Lessons in biology are taught in the lab.**

In attempt to make teaching and learning more real, the statement sought to learn how frequently teachers and students use laboratories. Additionally, it was to see if the teacher had been utilising the lab's supplies and tools for instruction. Table 3 displays the responses to this question.

**Table 3: Location of the biology lessons**

	Frequenc y	Percent
Strongly Agreed	1	2.4
Agreed	5	11.9
Disagreed	18	42.9
Strongly Disagreed	18	42.9
Total	42	100.0

According to Table 3's findings, 2.4%(1) highly agreed, 11.9%(5) agreed, 42.9%(18) disagreed, and 42.9%(18) strongly disagreed with the statement that most biology instruction take place in a lab. These findings suggest that biology classes were not delivered in a laboratory setting.

**Item 4: Every week, we normally have practical exercises at least twice.**

The purpose of the statement was to ascertain how frequently instructors and students went to the lab to put what they had learned theoretically into practise. Table 4 displays the responses to this question.

Table 4: How many practical events take place per week

		Frequenc y	Percent
	Strongly Agreed	2	4.8
	Not Known	3	7.1
	Disagreed	10	23.8
	Strongly Disagreed	27	64.3
	Total	42	100.0

Table 4's results showed that, when it came to the assertion that practical activities are normally held at least twice a week, 4.8%(2) strongly agreed, 7.1%(3) are not certain, 23.8%(10) disagreed, and 64.3%(27) severely disagreed. These findings demonstrate that teachers and students don't typically engage in practical activities on a regular basis. Due to this circumstance, children are unable to manage items to develop more practical skills that ultimately influence their achievement.

**Item 5: Generally, biology teachers instruct their students using laboratory apparatus.**

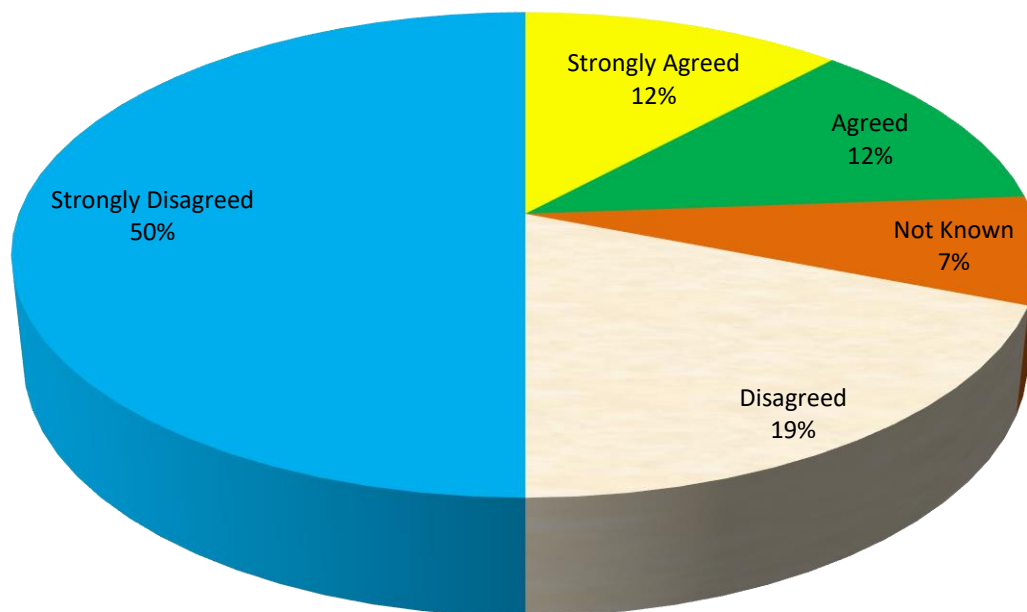
The purpose of the statement is to ascertain whether the teacher uses the laboratory's resource equipment and materials. Additionally, it aimed to see if teachers could effectively use the tools at their disposal. The information from this item is displayed in Table 5.

Table 5: The level of laboratory equipment use by biology teachers

	Frequenc y	Percent
Strongly Agreed	5	11.9
Agreed	5	11.9
Not Known	3	7.1
Disagreed	8	19.0
Strongly Disagreed	21	50.0
Total	42	100.0

According to Table 5's findings, 50%(21) strongly disagreed with the assertion that biology teachers use equipment in the lab to educate, with 11.9%(5) strongly agreeing, 11.9%(5) agreeing, 7.1%(3) are not certain, and 19%(8) disagreeing.

The study also intended to identify whether the teacher possessed the necessary abilities to effectively teach using the lab's tools. Figure 1 below shows the results of this.



**Figure 1:** A representation of a pie chart showing the proportions of teachers using lab equipment

The findings unambiguously show that the biology instructor in the school does not use the science tools in the lab for instruction. Students who have this mentality typically perform poorly on their final exam.

**Item 6: When teaching is combined with practical exercises, I fully comprehend the biology topic.**

The purpose of this claim was to ascertain how practical experiences affected students' biology achievement. Once more, the statement sought to ascertain students' attitudes about practical activities. Table 6 displays the outcome.

**Table 6: The results of combining instruction with practical activity**

	Frequency	Percent
Strongly Agreed	27	64.3
Agreed	7	16.7
Not Known	1	2.4
Disagreed	4	9.5
Strongly Disagreed	3	7.1
Total	42	100.0

Table 6 shows that 9.5%(4) disagreed, while 7.1%(3) strongly disagreed, whereas 64.3%(27) strongly agreed, 16.7%(7) agreed, 2.4%(1) not known, and 9.5%(4) disagreed. The comments make it very evident that practical exercises combined with instruction improve students' academic achievement in biology.

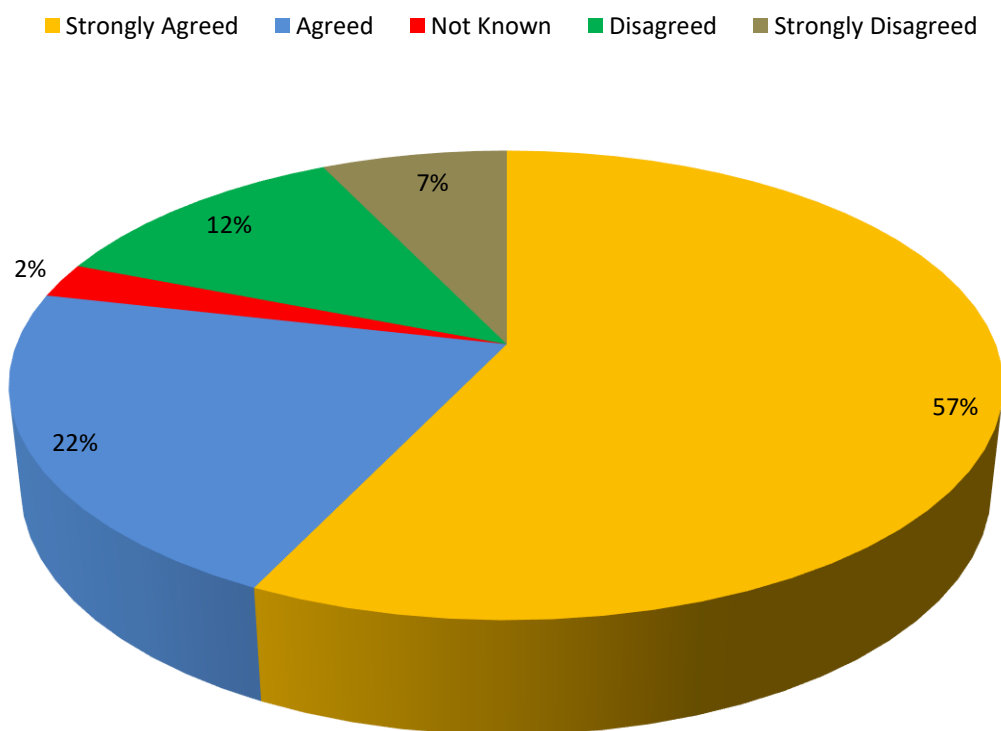
**Item 7: When given the chance to use devices myself, I am able to comprehend biology ideas quite effectively.**

The purpose of the statement was to ascertain whether or not students were allowed to utilise the instruments during practical activities. Some of their answers are displayed in Table 7.

**Table 7: Individual laboratory equipment handling**

	Frequency	Percent
Strongly Agreed	24	57.1
Agreed	9	21.4
Not Known	1	2.4
Disagreed	5	11.9
Strongly Disagreed	3	7.1
Total	42	100.0

According to Table 7's results, 57.1% of respondents agreed, 21.4% disagreed, and 7.1% strongly disagreed with the claim that "I comprehend the biology principles well any time I am given the option to control instruments myself." Therefore, based on these comments, it can be concluded that throughout biology practical courses, each student worked independently. Figure 2 is a graphic representation of Table 7 that makes it simple to grasp and interpret.



**Figure 2: Pie graph displaying the percentage of pupils that manipulate the equipment**

According to Figure 2, 79% of students concur that they have operated equipment in the lab. If this kept up, biology student performance would improve.

**Item 8: For biology classes, we frequently do field trips.**



The purpose of the statement was to ascertain whether students had engaged in fieldwork outside of the classroom and laboratory. Additionally, it intended to determine how students' attitudes regarding fieldwork affected their performance. Table 8 displays responses to question 8.

**Table 8: Biology-related effects of field excursion activities**

	Frequency	Percent
Strongly Agreed	5	11.9
Agreed	11	26.2
Not Known	3	7.1
Disagreed	10	23.8
Strongly Disagreed	13	31.0
Total	42	100.0

11.9%(5) highly agreed, 26.2%(11) agreed, 7.1%(3) not known, 23.0%(10) disagreed, and 31.0%(13) severely disagreed in Table 8 above. This showed that despite students taking field trips to understand biology, there was a dearth of biology field trips.

**Item 9: whenever teaching and learning are combined with practical exercises, I succeed on my term exam.**

In this claim, the impact of the biology lab on students' performance was explored. It also looked to see if theory and practise were combined in the course of teaching and learning. Table 9 lists the thoughts of the students.

**Table 9: Performance of learners as a result of fusing theory and practise**

	Frequency	Percent
Strongly Agreed	22	52.4
Agreed	9	21.4
Not Known	2	4.8
Disagreed	5	11.9
Strongly Disagreed	4	9.5
Total	42	100.0

According to Table 9, 52.4% (22) of respondents strongly agreed, 21.4% (9) agreed, 4.8% (2) were unsure, 11.9% (5) disagreed, and 9.5% (4) strongly disagreed. According to the responses, practical exercises are occasionally done in the classroom but not frequently.

**Item 10: The school has an adequate number of biology teachers.**

The purpose of the statement was to determine the school's teacher-to-student ratio and how it would impact learners' success. Additionally, it looked at some of the difficulties in teaching and understanding biology. The data gathered on this item is shown in Table 10 below.



**Table 10: Sufficient quantity of biology teachers in the institution**

Strongly Agreed	3	7.1
Agreed	5	11.9
Not Known	3	7.1
Disagreed	11	26.2
Strongly Disagreed	20	47.6
Total	42	100.0

According to Table 10's findings, there were enough biology professors in the school for 7.1%(3) strongly agreed, 11.9%(5) agreed, 7.1%(3) did not know, 26.2%(11) disagreed, and 47.6%(20) strongly disagreed. According to the replies above, there weren't enough biology teachers in the school, which might have an impact on kids' academic achievement.

**Item 11: The majority of the time, our biology teacher assigns us lab work.**

The purpose of the statement was to ascertain whether the biology teacher had evaluated the pupils both during and after practical demonstrations. Table 11 below shows the students' responses to this assertion.

**Table 11: Work at the laboratory**

	Frequenc y	Percent
Strongly Agreed	3	7.1
Agreed	2	4.8
Not Known	2	4.8
Disagreed	10	23.8
Strongly Disagreed	25	59.5
Total	42	100.0

Table 11 clearly shows that 23.8%(10) disagreed, whereas 59.5%(25) strongly disagreed. 7.1%(3) strongly agreed, 4.8%(2) agreed, 4.8%(2) not certain, and 23.8%(10) disagreed. This indicates that assignments for students to complete in the lab are typically not given by the teacher. Due in large part to the teacher's attitude, students perform poorly in the practical component of biology.

**Item 12: Every time we engage in practical exercises, I am normally supervised.**

If pupils are always monitored during practical tasks was the question's main objective. Additionally, the purpose of the statement was to ascertain whether students typically treat practical activities seriously. Table 12 displays the results of this.

**Table 12: Monitoring of students during practical activities**

	Frequenc y	Percent
Strongly Agreed	14	33.3
Agreed	11	26.2

Not Known	3	7.1
Disagreed	6	14.3
Strongly Disagreed	8	19.0
Total	42	100.0

According to Table 12 above, 14.3%(6) severely disagreed, 19.0%(8) highly disagreed, 26.2%(11) agreed, 7.1%(3) were unsure, and 33.3%(14) strongly agreed. The findings show that whenever a biology practical was conducted in the classroom, pupils were closely watched.

**Item 13: Our access to the lab to complete our homework is now accessible.**

In order to determine if students have access to the lab to complete their own schoolwork during break, this statement was made. Table 12 contains data from item 13 that was gathered.

**Table 13: Students' use of the laboratory**

Not Known	1	2.4
Disagreed	11	26.2
Strongly Disagreed	30	71.4
Total	42	100.0

Nearly 2.4%(1) of respondents in Table 13 are uncertain, 26.2%(11) disagree, and 71.4%(30) strongly disagree with the assertion. This demonstrates that students were never permitted in the lab. Only when doing an experiment with their teacher in the lab are students permitted access to the lab. This may result in students performing poorly on their final exam.

**Item 14: In order for me to understand biological ideas in the lab adequately, my teacher needs to provide me extra help.**

The purpose of the statement was to identify some of the obstacles that students face when learning biology in a lab setting. Additionally, it was to ascertain how instructors led their charges in the lab toward understanding and learning. Table 14 displays the responses to item 14.

**Table 14: Guidance from teachers during practical activities**

	Frequency	Percent
Strongly Agreed	30	71.4
Agreed	9	21.4
Not Known	1	2.4
Disagreed	2	4.8
Total	42	100.0

Approximately 71.4% (30) of the respondents in Table 14 strongly agreed with the statement, followed by 21.4% (9), 2.4% (1) who did not know, and 4.8% (2) who disagreed. These responses show that instruction is necessary for students to do practical tasks.

**Item 15: Biology is a challenging subject, thus I don't enjoy it.**

The purpose of the survey was to learn how students felt about biology as a subject. Additionally, the methods the teacher used to teach biology was to be revealed. Table 15 below shows the outcome of this.

**Table 15: Biology curiosity among students**

	Frequency	Percent
Strongly Agreed	1	2.4
Agreed	2	4.8
Not Known	1	2.4
Disagreed	9	21.4
Strongly Disagreed	29	69.0
Total	42	100.0

According to responses in Table 15, 2.4%(1) highly agreed, 4.8%(2) agreed, 2.4%(1) not sure, 21.4%(9) disagreed, and 69%(29) strongly objected to the statement that biology is a challenging subject. The responses show that pupils enjoy biology.

**Item 16: I find biology labs to be quite boring.**

This statement solicited student feedback on the structure of the school's biology practical. Additionally, it was to see if students consistently participated in the practical tasks. Table 16 contains the information that was gathered from item 16.

**Table 16: Views of students on the biology practical**

	Frequency	Percent
Strongly Agreed	2	4.8
Agreed	1	2.4
Not Known	3	7.1
Disagreed	10	23.8
Strongly Disagreed	26	61.9
Total	42	100.0

According to Table 16, the statement that biology practicals were always dull was supported by roughly 4.8%(2) strongly agreed, 2.4%(1) agreed, 7.1%(3) not known, 23.8%(10) disagreed, and 61.9%(26) severely disagreed responses. This shows that they consistently engage fully in biology practical training.

**Item 17: There are times when our biology teacher does not lead us through practical exercises.**

The purpose of the statement was to determine whether the biology teacher typically engages pupils in practical tasks. The biology teacher and students' attitudes toward practical exercises were also to be ascertained. Table 17 displays the responses that students provided in response to question 17.

**Table 17: Students' opinions on whether their teachers lead them via practical exercises**

	Frequency	Percent
Strongly Agreed	4	9.5
Agreed	5	11.9
Not Known	3	7.1
Disagreed	11	26.2
Strongly Disagreed	19	45.2
Total	42	100.0

Table 17 above shows that 26.2% (11) disagreed and 45.2% (19) strongly disagreed, with 9.5% (4) strongly agreeing, 11.9% (5) agreeing, 7.1% (3) not knowing. This demonstrates how the biology teacher has guided the class through biology practical.

### **Discussion of the Findings**

#### **What impact would the biology practical have on the academic achievement of biology students in senior secondary school?**

Several hands-on exercises were conducted with the students both inside and outside of the classroom. From terrestrial and aquatic areas, a variety of plant and animal specimens were gathered. Students were instructed to name them and describe the biological characteristics of these specimens that allow them to survive outside and procreate. Students displayed some of the organisms they had gathered on a microscope, and their job was to study and depict them. Additionally, students gave presentations of some of the assignments they were given in class, to which their classmates contributed and clarified by asking questions. All of the pupils at Queen of Peace Senior High School are now interested in learning biology thanks to the activities that were conducted. The study's conclusions showed that pupils are far more engaged while interacting with teaching and learning materials than when they are not. This study also shown that when using educational materials, pupils of all age groups perform better. The many senses in the body are stimulated by instructional materials. They aid in improving student learning. Their performance on the post-test findings shows this.

### **Recommendations**

The subsequent recommendations are given in light of the study's results and conclusions:

- In order to give Queen of Peace learners the opportunity to research and learn about science, the headmistress of the senior high school should make an effort to transport students to schools that have Science Resource Centers (SRC) facilities.
- Teaching methods employed in the teaching of biology should be adaptable enough to account for the variation among the learners. Teachers should adopt inventive strategies to educate, involving students in different hands-on activities even in the lack of the conventional equipment and supplies. If available, appropriate teaching and learning resources should be employed when instructing biology.
- To foster good relationships amongst students, grouping them into mixed-ability groups should be encouraged.
- To avoid a complete breakdown of the science lab, the headmistress of Queen of Peace Senior High School should try to restock depleted stocks and also replace other damaged equipment parts. Students should be encouraged, with the teacher's effective guidance, to explore new learning strategies that can significantly increase their interest in learning biology.

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