EFFECT OF LABORATORY INSTRUMENT FOR SCIENCE STUDENT IN PHYSICS IN SENIOR SECONDARYSCHOOLS IN ILORIN WEST, KWARA STATE

BY

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CERTIFICATION

This is to certify that this research work was carried out by Kolawole John Mayowa with Matric Number: KWCOED/IL/22/1175 of the Kwara State College of Education Ilorin, Nigeria

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DEDICATION

This project is dedicated to Almighty God the most beneficent, merciful and the most high for sparing my life throughout the period of my programme.

ACKNOWLEDGEMENT

With a sincerity of heart, I wish to express my fullest gratitude to my everlasting God for granting me the opportunity, ability and strength to attain this level in education

I am deeply grateful to discipline supervisor, Mrs A.M Junaid who showed keen interest in progress since the inception of this work.

I equally acknowledge the effort my lecturers, Mr Sadiq B.N, Mr Idris B.A Dr. Afolabi and others. The hand of God will not depart from your lives and families.

I would like to extend my heartfelt gratitude to my exceptional parents Mr &Mrs Michael kolawole, for their unwavering support Both financially and through their invaluable guidance. Their contribution have played a crucial role on my journey and I truly appreciate their commitment and encouragement. May Almighty God give them long life and prosperity to witness and benefit from the success of my life

I am also deeply grateful to my able brother in person of Mr Mathew and Lola and all others well wisher for their commitment towards the success of this project work.

ABSTRACT

The purpose of the study was to establish the effect of laboratory instruments on students' academic performance in physics subjects in public secondaryschools in Nigeria. Specifically, the study was set to establish the availability of laboratory instruments and equipment in public secondary schools, to find out the extent to which the physics teachers use laboratory instruments in teaching physics subjects, to establish the relationship between laboratory instruments and the students' academic performance in physics subjects and to establish the challenges faced by the school principals in provision of laboratory instruments. The study was effectd by the fact that the performance of students in physics subjects in ilorin west local government of kwara state. The researcher used purposive samplingto select one (1) national school, one (1) extra countyschool and two (2) countyschools.The researcher usedsimple random sampling to select twenty one.The researcher used three sets of questionnaires, one for the principals, the other forthe teachers and another for students. Quantitative data was analyzed using statistical Package for Social Physicss and the results presented in frequency tables, bar graphs and percentages to make meaningful conclusions. From the study it was established that; there is significant relationship between laboratory instruments and the students' academic performance in physics subject.Teachers' use of laboratory instruments in teaching physics subjects had effect on students' performance in physics subjects and managing class sizes posed a challenge to principals in provision of laboratory instruments in public secondary schools. The researcher recommends that principals should work hand in hand with parents, sponsors and other stakeholders in education to prioritize the provision ofadequate laboratory instruments, Physics teachers should also be taken for further training to make them more competent in teaching of physics subjects. Students should be given more opportunities to experience physics by being exposed to more laboratory practicals and the government should provide some laboratory equipment to schools to subsidize their costs and encourage the local chemical manufacturers to produce more affordable chemicals and laboratory equipment.

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CHAPTER ONE

INTRODUCTION

Background to the Study

Education is a very important human activity (Gok, 2023). It helps any society fashion and model individuals to function well in their environment. Boit, Njoki and Chang'ach, (2022), highlighted the benefits of education as: improving the productive capacity of the society, reducing poverty by mitigating its effects on population, health and nutrition. Secondary education is an important sector for national and individual development. Secondary education plays a vital role in creating a country's human resource base at a level higher than primary education (Achoka, Odebero, Maiyo & Mualuko, 2018).

The provision of quality secondary education is therefore important in generating the opportunities and benefits of social and economic development (Onsomu, Muthaka, Ngware & Kosimbei, 2018). One of the indicators of quality of education being provided is cognitive achievement of learners (United Nations Educational, Scientific and Cultural Organization, (UNESCO, 2018). Accordingto Adediwura and Tayo (2018), academic

achievement is designated by test and examination scores or marks assigned by the subject teachers.

In Nigeria, the education system is largely examination oriented. The quality of education tends to be evaluated in terms of the number of students passing national examinations (Eshiwani, 2023). Educators and the general public have time and again expressed concern over factors that effect student performance in examinations especially in physics subjects. The students' academic performance of physics subjects has always been wanting in Nigeria hence drawing a widespread interest on improving the levels of physics subjects achievement in public secondary schools .Apart from the economic benefits that it is argued this would bring, by better preparing young people for the numeracy demands of modern work places and raising the overall skill levels of the workforce, there are also social benefits tied to improving access for larger numbers of young people to past- school education and training opportunities and laying stronger foundations to skills for life learning.

For successful achievement of academic performance in schools there is need to provide key physical infrastructure which include:- physics laboratory,

school library, classrooms and various types of solid waste disposal. Physics laboratory is central to scientific instruction where theoretical work is practicalized where else practicals in any learning experiences involve students in activities such as observing, counting, measuring, experimenting and recording (Ogunniyi, 2023). Without proper and well- equipped physics laboratory, it is not possible to carry out the physics teaching process effectively in any school or educational institution.

One of the vehicles by which the process in inquiry can be leant is the laboratory where the student experiences the inquiry process, thus the study in a laboratory is an integral and essential part of physics subjects. Physics laboratory activities are hands-on experiences which emphasis process skills (Dike, 2018) which Agbo (2021) posited as motor skills that help the scientists to find answers to problems and enhance the learning of physics. Laboratory activities stimulate learners interest as they are meant personally engage in useful scientific activities and experiments. This affords the learners the basic skills and scientific methods of problem solving. Ado (2021) further opined that it is very necessary that students manipulate materials and equip in learning of Physics through equipment; this will help them not only to acquire physics process skills and new knowledge but also scientific attitude such as

honesty, open-mindedness and cooperation as moralities of physics and enhance understanding and retention of difficult concepts and procedures. Laboratory instruments give students some basic insight into scientific concepts and leave them with feeling of the reality of physics which in turn improves their academic performance in examination (Habu, 2015).

The interest in raising levels of achievement has led to a focus on identifying the range of factors that shape achievement as well as understanding of how these factors operate to limit, as well as enhance the achievement of different groups of students. Such efforts include the introduction of SMASE Project and in-service training for the teachers. This study will therefore seek to establish the effect of laboratory instruments on students' academic performance of physics subjects.

Statement of the Problem

The Nigeria Certificate of Secondary Education results released in every year by Nigeria National Examinations Council have shown that physics subjects are recording low (poor) grades in the country, contrary to the expectation of students, teachers and parents (Gok,2014). Efforts have been made by the government to improve the performance of physics by

introducing Project, embracing in-service training for the teachers and rewarding the best performing students by giving them scholarship for higher education. However, the performance of students in physics subjects in the Country. Several studies have been carried out to establish the factors that contribute to poor performance in secondary schools; however such studies focused on students' attitude towards education, cultural factors and personal characteristics of students. Although the above factors have been addressed towards students' performance, there is still need to address the performance challenges in physics subjects faced by students. This study therefore seeks to establish the effect of laboratory instruments on students' academic performance in physics subjects in public secondary schools in Ilorin West Local Government of Kwara State.

The Purpose of the Study

The purpose of this study was to determine the effect of laboratory instruments on students' performance in physics subjects in public secondary schools in Ilorin West Local Government of Kwara State.

Objectives of the Study

The objectives of this study were:-

(i) To establish the availability of laboratory instruments and equipment in public secondary schools, in Ilorin West Local Government of Kwara State.

(ii) To find out the extent to which the physics teachers use laboratory instruments in teaching physics subjects in public secondary schools in Ilorin West Local Government of Kwara State.

(iii) To establish the relationship between laboratory instruments and the students' academic performance in physics subjects in public secondary schools in Ilorin West Local Government of Kwara State.

(iv) To establish the challenges faced by the school principals in provision of laboratory instruments in public secondary schools in Ilorin West Local Government of Kwara State.

Research Questions

The study was guided by the following research questions:-

i). Which laboratory instruments are available in teaching of physics subjects in public secondary schools?

ii). To what extent do physics teachers use laboratory instruments in teaching of physics subjects in public secondary school?

iii). What is the relationship between the available laboratory instruments and students'performance in physics subjects in public secondary schools?

iv). What challenges do the principals face in provision of laboratory instruments in teaching of physics subjects in public secondary schools?

Significance of the Study

This study will be useful to the teachers who teach physics subjects in secondary schools because it contributes valuable knowledge on the effect of laboratory instruments in enhancing the academic performance of students in Physics subjects in Ilorin West Local Government of Kwara State. The study may also help the teachers and pupils re-think their approach on the use of laboratory instruments in schools. The study also suggests significant policy statements through its recommendations on availability of physical resources in the secondary

schools. The recommendations will help the school administration and management boards to prioritize and avail the necessary resources to improve the academic performance of students in physics subjects.

Limitations of the Study

Some of the principals were not available for interviews due to tight schedules. Efforts were made to make prior appointments booking on the date the researcher was to meet the respondents. Some respondents hesitated to provide useful information for the study due to fear of exposing the status of their institutions. The researcher overcame this by assuring the respondents that the findings of the study were used for academic purpose only.

Delimitations of the Study

The study focused on effect of laboratory instruments on students' academic performance in physics subjects in Ilorin West Local Government of Kwara State. The study respondents included principals, teachers and form three students in public secondary schools.

Operational Definition of Terms

Laboratory Instruments: refers to the building and equipment used in teaching physics subjects.

In-service: refers to taking teachers who are already employed for further training, seminars and workshops organized by the employer while they are still on the job.

Principal: refers to school's administrator appointed by TSC in accordance with education Act. 2022.

Public School: refers to schools owned by the government and benefiting from government subsidiary and staffing.

Physics Subjects: refers to chemistry, physics and biology offered in public secondary schools.

Students' Performance:** refers to the grades both per subject and overall that the students obtains in Nigeria Certificate of Secondary Education Examinations.

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CHAPTER TWO

LITERATURE REVIEW

Introduction

This chapter contains various scholarly works that have been reviewed for the purpose of this study. It focuses on the adequacy of laboratory instruments in public secondary schools, the effects of laboratory instruments on the academic performance of students in physics subject in public secondary schools, the extent to which the physics teachers use laboratory instruments when teaching physics subjects in public secondary schools, and the challenges faced by the school principals in provision of laboratory instruments in public secondary schools. Summary and research gaps are also discussed.

Overview of School Physics Laboratory and Physics Performance

Physics educators increasingly perceive the school physics laboratory as a unique learning environment in which students can work cooperatively in small groups to investigate scientific phenomena and relationships. Hofstein and Lunetta (2018), Lazarowitz and Tamir (2019), and Lunetta (2018) suggested that laboratory activities have the potential to enable collaborative

social relationships as well as positive attitudes toward physics and cognitive growth. In this review, it is noted that the more informal atmosphere and opportunities for more interaction among students and their teacher and peers can promote positive social interactions and a healthy learning environment conducive to meaningful inquiry and collaborative learning. The laboratory offers unique opportunities for students and their teachers to engage in collaborative inquiry and to function as a classroom community of scientists. Such experiences offer students opportunities to consider how to solve problems and develop their understanding. Through collaboration, they can also come to understand the nature of an expert scientific community. These are among the learning outcomes now thought to be very important in introductory physics.

The importance of promoting cooperative learning in the physics classroom and laboratory received substantial attention during the 2018 (e.g., Johnson et al., 1981; Johnson & Johnson, 2016; Lazarowitz & Karsenty, 2020) as a way to engage diverse students in collaboration with others in inquiry and to develop a classroom community of scientists.

Large numbers of studies demonstrated distinct benefits in students' achievements and productivity when cooperative learning strategies were utilized in the classroom-laboratory. In the intervening years, research intended to examine the effects of student collaboration and the development of "classroom community of scientists" has been increasingly visible. Okebukola and Ogunniyi (2024) compared groups of students who worked cooperatively, competitively, and as individuals in physics laboratories and found that the cooperative group outperformed the other groups in cognitive achievement and in process skills. Similarly, Lazarowitz and Karsenty (2020) found that students who learned physics subjects in small cooperative groups scored higher in achievement and on several inquiry skills than the students who learned in a large group class setting. Several papers have reported that the more informal atmosphere and opportunities for more interaction among students and their teacher and peers can promote positive social interactions and a healthy learning environment conducive to meaningful inquiry and collaborative learning (DeCarlo & Rubba, 2024; Tobin, 2023).

The Effects of Laboratory Instruments on Students' Academic Performance

Laboratory has been conceptualized as a room or a building specially built for teaching by demonstration of theoretical phenomenon into practical terms. Farombi (2018) argued the saying that "seeing is believing" as the effect of using laboratories in teaching and learning of physics and other physics related disciplines as students tend to understand and recall what they see than what they hear or were told. Laboratory is essential to the teaching of physicss and the success ofanyphysicscourseis much dependent on thelaboratoryprovision made for it. Affirming this, Ogunniyi (2023) said there is a general consensus among physics educators that the laboratory occupies a central position in physics instruction. It could be described as a place where theoretical work is practicalized whereas practicals in any learning experience involve students in activities such as observing, counting, measuring, experimenting, recording, observation and carrying out field work. These activities are totally different from the theoretical work which involves listening to talks and taking down notes from such talks.

According to Ango (2016) laboratory work stimulates learners' interests as they are made to personally engage in useful scientific activities and experimentation; promotes that physics is not only product or process; affords the learner the basic skills and scientific method of problem solving and knowledge obtained and promotes long term memory.

Laboratory helps to provide a forum wherein the learner is given the exercise to subjects, his beliefs, ideas, statements, theoretical propositions etc. to some forms of experimental test (Soyibo, 2019). To maintain and arouse the interests of students in subjects involving laboratory work, the teacher should be effectively involved in order to transfer knowledge and facts to learners for a good performance in any examinations. In line with this, one then pauses to ask, to what extent has laboratory been able to achieve its objectives. Odulaja and Ogunwemimo (2019) highlighted that the teacher assumes a position of dispenser of knowledge with the laboratory serving the function of drill or verification. They further explained that at the other extreme, the teacher assumes the position of guide to learning and laboratory as a place where knowledge is discovered. However, there are growing evidences that teachers do not exhibit behaviours which are complementary to achieving the stated objectives. They include methods of teaching practical

work; inadequacy or absence of well-equipped laboratories; high enrollment of students; inadequacy of resources for teaching and learning practical work; quantity and quality of teachers.

Nwachukwu (2022) discovered in her survey of the resources for the teaching and learning of Physics subjects in some of the new secondary schools in Lagos that there was a general in adequacy of resources. She also found out among other things that out of 80 percent of the old schools that accepted as having laboratories, none had a well-equipped laboratory and 40 per cent of the schools had no laboratory at all, while the remaining 60 percent had rooms labeled "laboratory" without adequate apparatus, she concluded that teaching of physics subjects practicals' by teachers would be difficult and that students learning experiences would be limited. In his contribution, Balogun (2018) submitted that no effective physics education programme can exist without equipment for teaching. Writing on the situation of our secondary schools today, Okoli (2015) reported that laboratories have become shelves of empty bottles of chemicals. In terms of academic achievement, Soyibo and Nyong (2022) have shown that schools with well-equipped laboratories have better results in the school certificate physics examinations than those that are ill-equipped. Corroborating this,

Gana (2021) reiterated that students instructed entirely by the laboratory methods had higher attitude's scores but lower achievement scores than students instructed entirely by the traditional lecture or textbook mode.

Yadar (2021) opines that no course in physics subjects can be considered as complete without including some practical work. The practical work ought to be carried out by individuals either in physics laboratories or in classes. At school level, practical work is even more important because of the fact that we learn by doing. Scientific practices and applications are thus rendered more meaningful. It is an established truth that an object handled impresses itself more firmly on the mind than the object merely seen from a distance or in an illustration. Thus practical work forms an important feature in physics subjects courses (UNESCO, 2018). In view of these different and conflicting findings, the study found the relationship between teachers' quality and students' academic achievement.

The Extent to which the Laboratory Instruments are used by Teachers in Teaching Physics Subjects

Tobin and Gallagher (2021) found that physics teachers rarely, if ever, exhibit behavior that encourages students to think about the nature of scientific inquiry and the meaning and purposes for their particular

investigation during laboratory activities. On the basis of a comprehensive study on implementation of the laboratory in schools in British Columbia, Gardiner and Farrangher (2021) found that although many Physics subject teachers' articulated philosophies appeared to support an investigative, hands-on, minds-on approach with authentic learning experiences, the classroom practice of those teachers did not generally appear to be consistent with their stated philosophies. As noted in the preceding section, Hodson's observations of the mismatch between teacher's rhetoric and practice, also complicate obtaining valid and reliable information based only upon teachers' self-reports.

Several studies have reported that very often teachers involved students principally in relatively low-level, routine activities in laboratories and that teacher–student interactions focused principally on low-level procedural questions and answers. Marxetal. (2018) reported that physics teachers often have difficulty helping students ask thoughtful questions, design investigations, and draw conclusions from data. De Carlo and Rubba (2019) reported similar findings in chemistry laboratory settings. Earlier, Shymansky and Penick (2019) had written that teachers do not perceive that

laboratory activities can serve as a principal means of enabling students to construct meaningful knowledge of physics, and they do not engage students in laboratory activities in ways that are likely to promote the development of physics concepts. They may not perceive that they can manage laboratory activities in ways that are consistent with contemporary professional standards. In addition, many teachers do not perceive that helping students understand how scientific knowledge is developed and used in a scientific community is an especially important goal of laboratory activities for their students. As noted in other sections of this review, several researchers have continued to observe that many physics teachers do not utilize or manage the unique environment of the school laboratory effectively. Conditions are especially demanding in physics laboratories in which the teacher is to act as a facilitator who guides inquiry that enables students to construct more scientific concepts. Contemporary teaching standards place a heavy burden on the physics teacher. Inquiry-focused teaching now rests on the constructivist notion that learning is a process in which the student actively constructs her or his own ideas that are linked with other ideas in increasingly complex networks. The constructivist model, when practiced, is a relatively radical departure from traditional teaching and learning practice.

Teachers are often not well informed about these new models of learning (Cohen, 2019; Polman, 2019) and their implications for classroom teaching and curriculum. While excellent examples of teaching can be observed, the classroom behaviors of many teachers continue to suggest the conventional belief that knowledge is directly transmitted to good students and that it is to be remembered as conveyed.

In addition, many teachers lack experience with assessment methods aimed at assessing their students' understanding and performance in the physics laboratory (Yung, 2023). As a result, in many cases, students' final grades do not include a component that directly reflects their performance in laboratory work and their understanding of that work. Furthermore, Brickhouse and Bodner (2022) reported that students' concern about their grades has a strong effect on teachers' practices. More specifically, they suggested that some teachers will emphasize goals for learning and use teaching techniques that are aligned with students' ability to earn high grades. The need for meaningful, long-term professional development for physics teachers on these issues and for better communication between the physics education research community and the community of physics teachers is abundantly clear. These important issues are discussed further in

the Teacher Education and Professional Development section later in this review.

Challenges Faced by Principals in Provision of Laboratory Instruments

Principals are faced with multiple, complex and wide ranging challenges as they execute various roles and responsibilities relating to acquisition and implementation of laboratory instruments. The challenges include dealing with low motivation, managing class sizes, dealing with inadequate resources and managing with fewer funds (Oduro, 2019). In Liberia, for instance, education is engulfed with bribery, lack of infrastructural instruments and equipment coupled with unqualified lab instructors. Qualified and competent teachers are insufficient (Lavalah, 2019). In Southern Thailand, principals work under intensified and vulnerable situation, insufficient funding and also dealing with the effect of the intensity of cultural unrest and safety of students and staff (Sungtong, 2021).

Inadequate finance has also been noted by Kamunde (2010). In Pakistan head teachers have to deal with issues affecting teachers and student in laboratory related issues, the curriculum, parents, school visitors and central office. Other challenges include role ambiguity, the conflicting

expectations of various stake holders, the tension between in adequate financial resources and the lack of incentives and authority to deal with relevant issues relating to laboratory use. There are also issues linked to socio-political and sectarian conflicts and disruptions. As a result head teachers pay more attention to maintaining order and discipline than addressing the issues of staff development and support, and students' academic achievements (Shafa, 2011). Other challenges that affect head teachers or principals include issues with sponsors, security and quality of education. It is important however to mention that the challenges principals face are compounded by the fact that they are not trained and/supported in their roles and responsibilities.

Summary of Literature Review

Laboratory activities offer important experiences in the learning physicss that are unavailable in other school disciplines. For many years, laboratory experiences have been shown to promote key physics education goals (Hudson, 2023). This implies that laboratory experiences are therefore very important to a student as they enhance better understanding of physics and lead to better performance in physics. Lack of adequate exposure to practical work has been noted as one of the contributing factors to dismal

performance in examinations. G.O.K (2015) observes that some students saw and handled experimental equipments only during national examinations. The purpose of this study is therefore to investigate availability and use of school laboratory instruments and their effect on students' academic performance in physics subjects in public secondary schools in Ilorin West Local Government of Kwara State

CHAPTER THREE

METHODOLOGY

Introduction

The chapter presents the research design, location of the study, the target population, sampling techniques and sample size, research instruments, pilot study, validity, reliability, data collection techniques and data analysis techniques.

Research Design

This study used descriptive survey design. Descriptive survey describes collecting of data in order to answer questions concerning the current status of the study. Descriptive survey is chosen because it is appropriate for educational fact-findings and gives a great deal of information which is accurate. It also enables a researcher to gather data at a particular point in time and use it to describe the nature of the existing conditions (Colen, 2020).

Population

Borg and Gall, (2019) defines the target population as the population to which the researcher wants to generalize the results of the study. In Ilorin

West Local Government of Kwara State 10 public secondary schools were selected, 100 secondary schools teachers, 30 boys and 70 girls in SSS 3 The population of the study will be 100 teachers and 100 students.

Sampling Techniques and Sample Size

Kothari, (2024) defines a sample as a representative part of a population. Thus by studying the sample, one can be able to know more about the population without having to study the entire population. The sampling was done in Ilorin West Local Government of Kwara State. The study used purposive sampling to select School which is hundred percent (100%) When the population is small the whole population is taken as the sample. Simple random sampling was be used to select Schools.

The researcher sampled 23 principals which is thirty per cent (30%), 105 teachers which is thirty per cent (30%) of the teachers. According to Mugenda and Muganda (2021), a sample of thirty per cent (30%) is sufficient for a study. To sample the students, the researcher used Krejecie and Morgan table to select 351 form three students in public secondary schools, in Ilorin West Local Government of Kwara State.

Table3.1PopulationandSampleSize

School Category	**Total Number**	**Sample Size**	**Percentage of the Total schools**
Teachers	100	100	100%
Students	100	100	100%
TOTAL	**200**	**200**	

Research Instruments

The researcher used three questionnaires and observation schedule to conduct the study. According to Orodho (2018) a questionnaire is most used method when respondents can be and are willing to cooperate. Questionnaires ensure confidentiality of the respondents and thus they can gather candid and objective responses.

Questionnaires were administered to the principals, teachers and students. The researcher used close-ended questions, open-ended questions, contingency and matrix questions. Open ended items required the subjects to give direct views. Close- ended items required definite answers. The research

instruments used provided the researcher with an easy accumulation of data in the study. Questionnaires give respondents freedom to express their views and make suggestions. The questionnaires collected background information in section A, Availability of laboratory instruments in section B, extent to which the teachers use laboratory instruments in section C, relationship between laboratory instruments and academic performance in section D and challenges faced by principals inprovision of laboratory instruments in section E.

Validity of Research Instruments

Validity indicates the degree to which an instrument measures what it purports to measure (Kothari, 2018). That is the extent to which differences found in the measuring instrument reflect true differences among those already tested. To ascertain the validity, the instruments were discussed with supervisors and experts in physics education.The researcher assessed the relevance of the content used in the instruments developed and made structural changes for purpose of improvement and reinforcement of the instruments before embarking on actual data collection.

Reliability of Research Instruments

Mugenda and Mugenda (2021) define reliability as a measure of the degree to which a research instrument yields consistent results or data after repeated trial. Piloting enabled the researcher to test the reliability of the instrument. To ensure reliability, the researcher employed the test-retest technique. This involved administering the test to one appropriate group selected randomly. After two weeks, the same test was administered to the same group. The two sets of scores Were regressed using the Pearson's product moment correlation coefficient formula, to determine the correlation coefficient (r) between the two sets of scores.

$$r = \frac{n\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{[n\Sigma^2 - (\Sigma X)^2][nY^2 - (\Sigma Y)^2]}}$$

Where x = first set of scores; Y = second set of scores; $\sum x$ = the sum of the firstset of scores; $\sum y$ = the sum of second set of scores; $\sum x^2$ = the sum square of first set of scores; $\sum y^2$ = the sum square of second scores; $\sum xy$ = the sum of cross product of x and y and n = total number of respondents.

The correlation coefficient obtained was 0.733 for principals' questionnaire, 0.709 for teachers' questionnaire and 0.765 for students' questionnaire. This means the research instruments could be relied upon for this study. A correlation coefficient of between 0.7 to 1 is considered reliable (Mugenda & Mugenda 2021).

Data Collection Techniques

The researcher obtained research permit from the National Commission for Physics, Technology and Innovation (NACOSTI) before embarking on the study. The researcher then paid a courtesy call to the Sub-County Director of Education, Ilorin West Local Government of Kwara State and explained the intention to carry out the research.The researcher then made appointment with the public secondary school principals. The researcher personally administered the research instruments to the subjects. The secondary school teachers accompanied the researcher in their classes, introduced her to the students and allowed her to administer the questionnaires.

The researcher then collected the questionnaires immediately after they have been filled.

Data Analysis

This is the process of organizing the collected data and putting it together so that the researcher can meaningfully, categorize and synthesize information from the data collecting tools, Mugenda and Mugenda (2021). Data gathered is coded for analysis and entered using SPSS. This is done often editing and checking out whether all questionshave been filled in correctly. Quantitative data was analyzed using statistical package for social physics and the results presented using frequency tables, bar graphs and percentages to make meaningful conclusions. This was deemed to make interpretation easy and convenient in giving general overview of the problem under study. Research questions were analyzed using descriptive statistics and the results represented in tables and bar graphs.

Qualitative data was analyzed through content analysis which in turn were analyzed by organizing data into themes, patterns and sub- topics according to themes in the research objectives, and presented in a continuous prose.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

Introduction

This chapter deals with the analysis, presentation and interpretation of the data and discussions based on the objectives. The study sought to establish the effect of laboratory instruments on students' performance in physics subjects in public secondary schools in Ilorin West Local Government of Kwara State.

ResponseRate

The respondents involved were the school principals, teachers and students. They returned the questionnaires as tabulated in Table 4.1.

Table4.1:Instrument Return Rate

Respondent	Sampled Size	No.Collected	Return Rate(%)

s			
Principals	23	23	100
Teachers	105	80	76.2
Students	351	211	60

Table 4.1 shows that the average questionnaire return rate was well above 70% which according to Mugenda and Mugenda (2021) is an acceptable proportion and can be termed adequate for analysis.

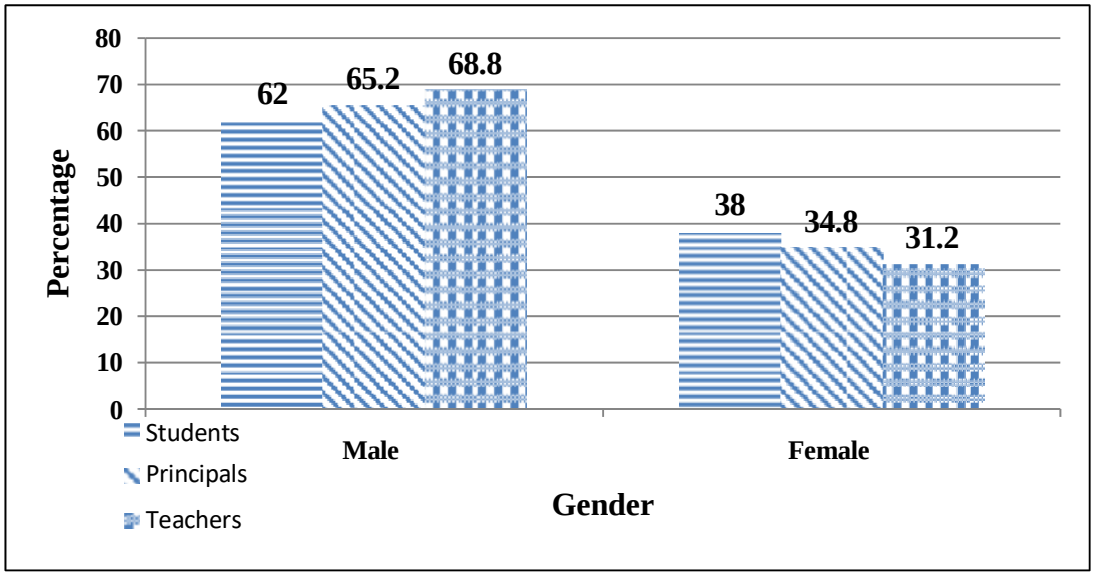
Demographic Information

Demographic Data of Principals, Teachers and Students

The demographic data of principals, teachers and students was based on their gender, age, highest academic qualification, professional experience in years and the number of years in the current school.

Respondents were asked to indicate their gender. Responses are summarized and presented in figure 4.1.

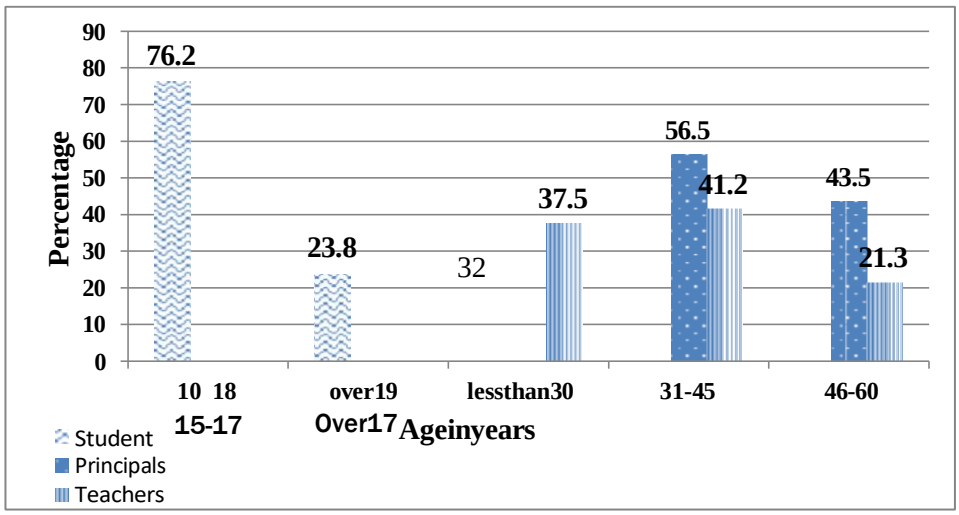
Figure4.1:Gender of Principals, Teachers and Students



Findings in figure 4.1 show that 65.2% of the principals were male, 68.8% of the teachers were male and 62% of the students were male. This shows that the study was dominated by male principals, teachers and students which could be attributed to the fact that most schools in the study were boys' schools.

The study sought to establish the age of principals, teachers and students. Responses are summarized and presented in figure 4.2.

Figure 4.2 :Age of Principals, Teachers and Students



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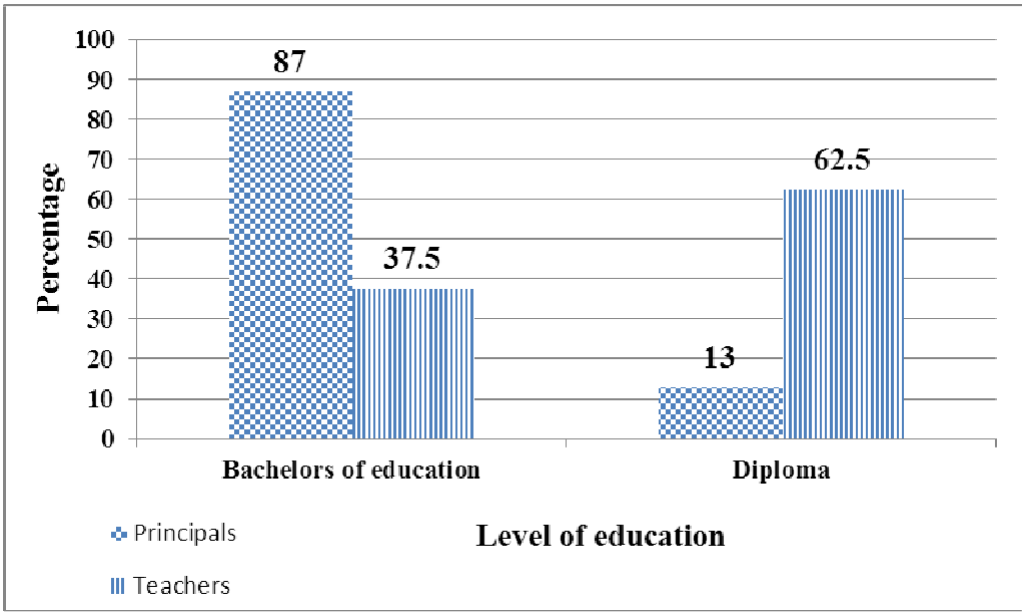
Findings in figure 4.2 show that 56.5% of the principals were aged between 31-45 years, 41.2% of the teachers were aged between 31-45 years and 76.2% of the students were aged between 15-17 years. This shows that the principals, teachers and students were relatively mature and hence would understand the concept ofthe study. The principals and teachers were asked to indicatetheirlevelofeducation. Responses are summarized and presented in figure 4.3 page 32.

Figure4.3:Principals'andTeachers'Level of Education

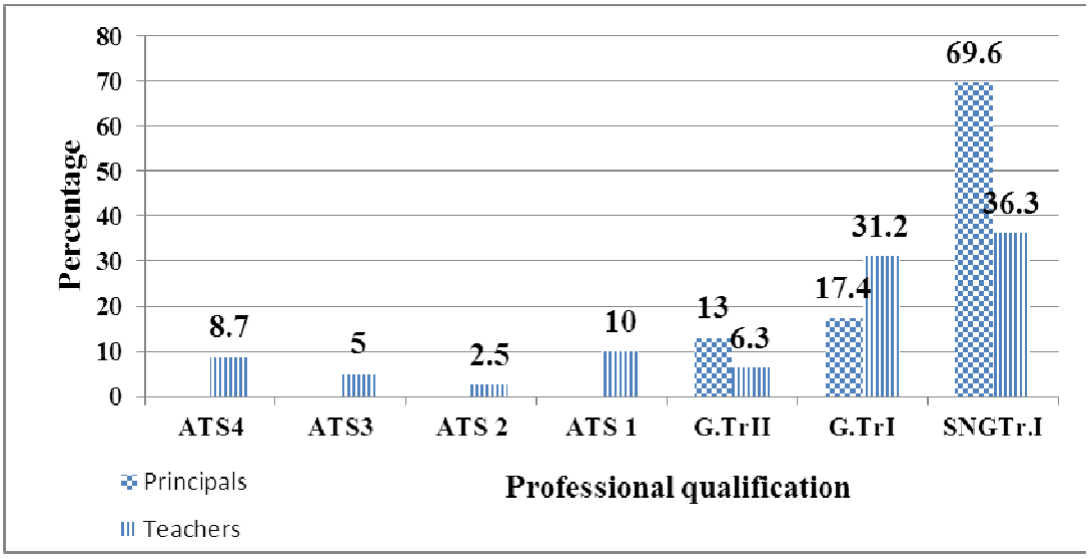


Findings in figure 4.3 show that 87% of the principals had attained Bachelors of Education and 62.5% of the teachers had attained Diploma. This shows that the principals and teachers were well educated to take up school

leadership and teach physics subjects.

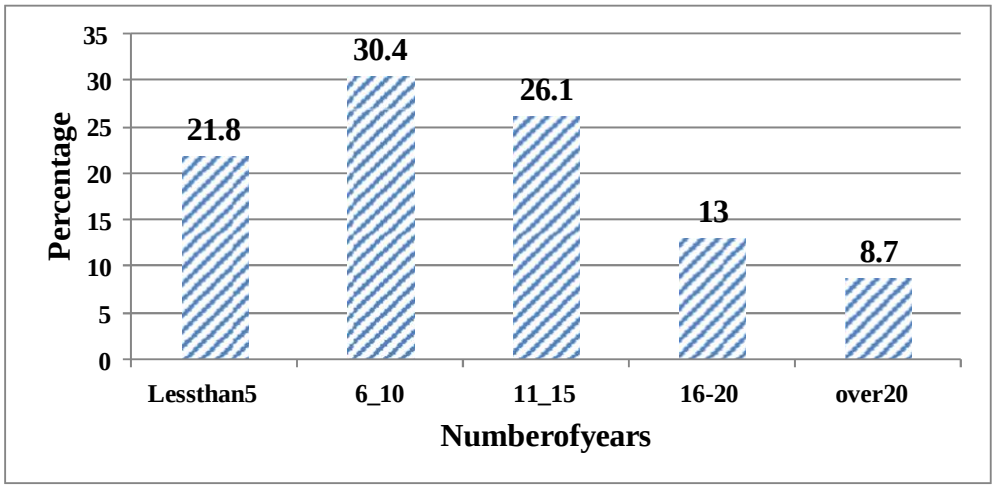
The principals and teachers were also asked to indicate their highest professional qualification. Responses are summarized and presented in figure 4.4 on page 33.

Figure4.4:Principals'andTeachers'HighestProfessionalQualification



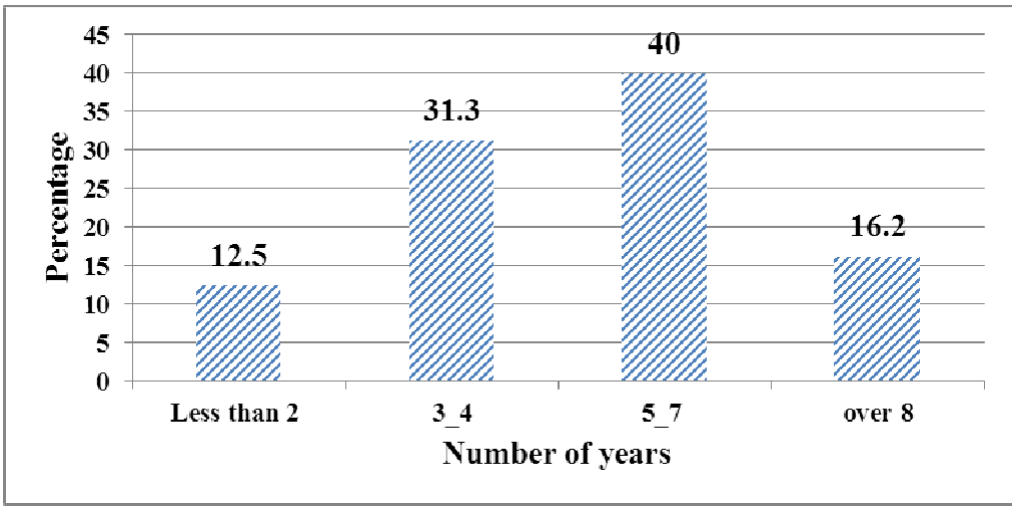
Findings in figure 4.4 showthat69.6%oftheprincipalsand36.3%oftheteachers possessed asenior grade teacher. This shows that theprincipals and teachers were well trained to teach in secondary schools. Principals were asked to indicate the number of years they have been heading the school. Responses are summarized and presented in figure 4.5 on page 34.

Figure4.5:NumberofYearsasPrincipal



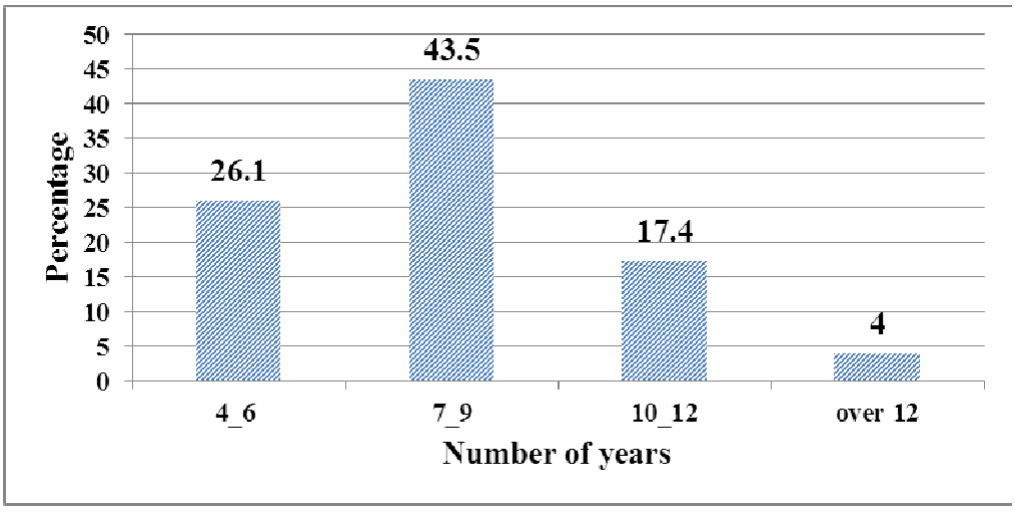
Findings in figure 4.5 show that 30.4% of the principals have been school heads forbetween 6-10 years. This shows that the principals were in a position to understand the effect of laboratory instruments on students' performance in physics subjects in public secondary schools in Ilorin West Local Government of Kwara State due to the number of years they have been the head of school. Teachers were also asked the number of years in the teaching profession. Responses are summarized and presented in figure 4.5 on page 35.

Figure4.6:NumberofYearsintheTeachingProfession



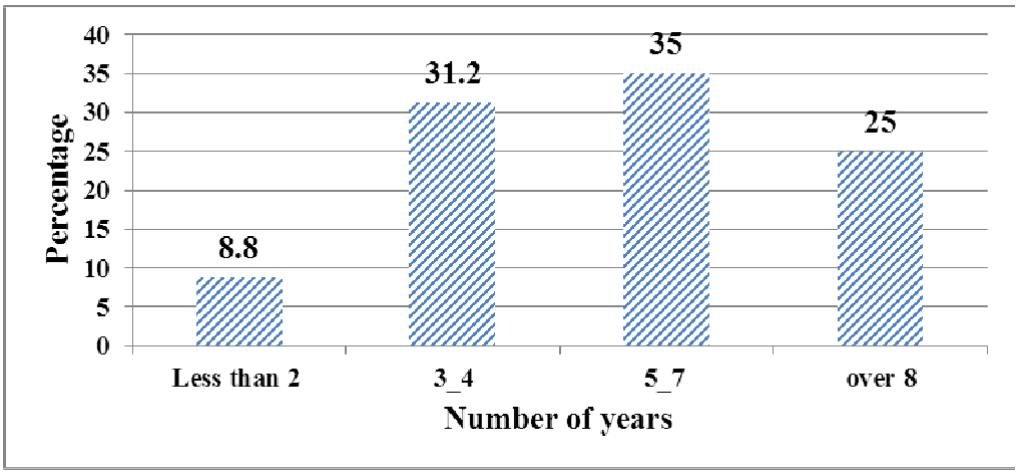
Findings in figure 4.6 show that 40% of the teachers have been in the teaching profession for between 5-7 years. This implies that the teachers were in a position to understand the effect of teaching aids in the laboratories on the performance of students. Principals were further asked to indicate the number of years they have been in the current school. Responses are summarized and presented in figure 4.7 on page 36.

Figure4.7:PeriodofWorkingintheCurrentSchool



Findings in figure 4.7 show that 43.5% of the principals have been in the current schoolfor between7-9 years. Thisshowsthatprincipalshad enough experiencein management of schools thus in a position to understand the effect of laboratories on performance. The teachers were also asked to indicate the number of years they have taught physicssubjects. Responses are summarized and presented infigure 4.8 on page 37.

Figure4.8:Period of Teaching Physics Subjects.



Findings in figure 4.8 show that 35% of the teachers have been teaching mathematics and physicss for between 5-7 years thus in a good position to understand the impact of well-equipped laboratories on performance of thePhysics subjects.

Availability of Laboratory Instruments and Equipment

The first objective of the study was to establish the availability of laboratory instruments and equipment in public secondaryschools. Principals and teachers were asked to indicate the adequacy of laboratory instruments in their schools. Responses are summarized and presented in table 4.2.

Table4.2:Adequacy of Laboratories

Adequacy	Frequency	Percentage
Very adequate	10	9.7
Adequate	23	22.3
Inadequate	70	68.0
Total	**103**	**100**

Findings in table 4.2 show that 68% of the respondents indicated that laboratory instruments in their schools were inadequate which affected learning of physics subjects. This implies that secondary schools in the study area have very few laboratories and it concurs with Yadar (2011) who argued that no course inphysics subjects can be considered as complete without including some practical work which is carried out in the laboratory. Shortage of laboratories contributes to low performance especially in physics subjects.

Principals were asked to indicate the appropriate situation of the laboratory instruments in their schools. Responses are summarized and presented in table 4.3.

Table4.3:Situation of the Laboratory Instruments

Facility	Very Adequate %	Adequate %	Not Sure %	Inadequate %	Very Inadequate %
Chemistry laboratory		8.7	13.0	34.8	43.5
Biology laboratory		4.3	8.7	48.0	39.0
Physics laboratory			17.4	56.5	26.1
Computer laboratory			8.7	26.1	65.2

N=23

Findings in table 4.3 show that: the chemistry laboratory are very inadequate as indicated by 43.5% of the respondents, biology laboratory are inadequate as indicated by 48%, physics laboratory are inadequate as indicated by 56.5% and computer laboratories in the schools are very inadequate as indicated by 65.2% of the respondents. This implies that the situation of the laboratory instruments in the schools in the study area is very devastating thus physics education programs in the schools are ineffective.The findings concur with Balogun (2018) who asserted that no effective physics education program can exist without instruments forpractical teaching like laboratories. Laboratory is essential to the teaching of physicss and the success of any physics subject is much dependent on the laboratory provision made for it and lack of it

contributes to dismal performancein physics subjects.

The researcher also sought to find out from the teachers the instructional materials available in their school for teaching/ learning. Responses are summarized and presented in table 4.4.

Table4.4:Instructional Materials Available for Teaching/Learning

Instructional Materials	**Very adequate %**	**Adequate %**	**Not Sure %**	**Inadequate %**	**Very Inadequate %**
Improved teaching Aids		3.8	8.7	25.0	62.5
Teachers prepared Teaching Aids	25.0	36.3	12.5	16.2	10.0
Textbooks	12.5	38.8	15.0	25.0	8.7
Exercise books	41.2	21.3	15.0	12.5	10.0
Other apparatus	5.0	10.0	33.8	37.5	13.7

N=80

Findings in table 4.4 show that: the improved teaching aids were very inadequate as indicated by 62.5% of the respondents. Teachers' prepared teaching aids were adequate as indicated by 36.3%, textbooks were adequate as indicated by38.8%, exercise books were very adequate as indicated by 41.2% and other laboratory apparatus were inadequate as indicated by 37.5%

of the respondents. This implies that the teachers in the study area prepare their teaching aids although the improved teaching aids were inadequate which pose a challenge to teaching/learning of physics subjects.The finding is in agreement UNESCO (2018) report that practical work forms an important feature in physics subjects' courses. Essential instructional materials available in the laboratorieshelpteachers to teach physics subjects which help them understand the concepts taught. Students were asked to indicate the physical features available in their school. Responses are summarized and presented in table 4.5.

Table4.5:PhysicalFeaturesAvailableinSchools

Physicalfeatures	**Available**		**Notavailable**	
	F	**%**	**F**	**%**
Laboratory	80	38.0	130	62.0
Library	75	35.7	135	64.3
Classroom	120	57.0	90	43.0

N=210

Findings in table 4.5 Show that; The classrooms were available As indicated by 57%, laboratories were unavailable as indicated by 62% and libraries were unavailable as indicated by 64.3%. This implies that secondary schools

in the study area have a shortage of the most critical physical instruments.This is in agreement with Eshiwani (2023) that school physical features such as laboratories, libraries, classrooms, have a direct impact on academic performance among students in developing countries. Laboratories offer unique opportunities for students and their teachers to engage in collaborative inquiry and to function as a classroom community of scientists thus improvingacademic performance.

Extent to which the Physics Teachers use Laboratory Instruments

The second objective of the study was to find out the extent to which the physics teachers use laboratory instruments in teaching physics subjects. Principals and teachers were asked to indicate how often they make use of the laboratoryinstruments in teaching physics subjects. Responses are summarized and presented in table 4.6.

Table4.6: Extent to which Teachers use Laboratory Instruments

Extent	Frequency	Percentage
Very great extent	29	28.1
Great extent	52	50.5
Moderate extent	12	11.7
Little extent	10	9.7
Total	**103**	**100**

Findings in table 4.6 show that teachers make use of the laboratory instruments in teaching physics subjects to a great extent as indicated by 50.5% of the respondents. This implies that physics teachers are ready and willing to use laboratories in teaching physics subjects so as to help students understand the physicss and improve their performance. The finding differs with Shy man sky and Penick (2019) who asserted that teachers do not engage students in laboratory activities in ways that are likely to promote the development of physics concepts. In order to maintain and arouse the interests of students in physicss, the teachers should be effectivelyinvolved in order to transfer knowledge and facts to learners for a good performance in examinations.

Students were also asked to indicate how often they take physics subjects in the laboratory. Responses are summarized and presented in table 4.7.

Table4.7: Frequency of Students using Laboratory Instruments

Frequency	**Frequency**	**Percentage**
Very frequently	36	17.0
Frequently	90	43.0

Rarely	51	24.3
Very rarely	33	15.7
Total	**210**	**100**

Findings in table 4.7 show that students frequently take physics subjects in the laboratory as indicated by 43% of the respondents. This implies that teachers make effort to teach physics subjects in the available laboratories to help students understand the subjects. This is in agreement with Brickhouse and Bodner (2022) who reported that students' concern about their grades has a strong effect on teachers' practices. Allowing students to use physics laboratories frequently shows teachers' commitment to teach physics subjects in laboratories.

Relationship between Laboratory Instruments and Academic Performance The third objective of the study was to establish the relationship between laboratory instruments and the students' academic performance in physics subjects. Teachers were asked to indicate the extent to which availability of laboratory instruments affect performance of students in physics subjects. Responses are summarized and presented in table 4.8.

Table4.8:Extent to which Laboratory Instruments Affect Academic Performance

Extent	Frequency	Percentage
Verygreatextent	41	51.2
Greatextent	25	31.3
Moderateextent	11	13.8
Littleextent	3	3.7
Total	**80**	**100**

Findingsintable4.8showthat51.2%oftherespondentsindicatedthat availability of laboratory instruments affect performance of students in physics subjects to a very great extent. This implies that schools with well-equipped laboratories have better results in the school certificate physics examinations than those that are ill- equipped.The finding concurs with Soyibo and Nyong (2022) that schools with well-equipped laboratories have better results in the school certificate physics examinations than those that are ill-equipped and lack of adequate exposure to practical work is one of the contributing factors to dismal performance in examinations. Laboratory work stimulates learners' interests as they are made to personally engage in useful scientific activities

and experimentation which promotes that physics is not only product or process but also affords the learner the basic skills and scientific methods of problem solving and knowledge obtained and promotes long term memory.

Challenges Faced by School Principals

The fourth objective of the study was to establish the challenges faced by the school principals in provision of laboratory instruments in public secondary schools. Principals were asked to indicate the challenges they face in providing the laboratory instruments. Responses are summarized and presented in table 4.9.

Table4.9: Challenges Faced by School Principals

Challenges	Frequency	Percentage
Inadequate resources	20	87.0
Unqualified lab instructors	18	78.3
Insufficient competent teachers	13	56.5
Managing class sizes	10	43.5

Findings in table 4.9 show that 87% of the respondents indicated that they face a challenge of inadequate resources to equip laboratories, 78.3% do not have qualified laboratory instructors, 56.5% have insufficient competent and qualified physics teachers and 43.5% of the respondents face challenges in managing the classsizes. This shows that the principals face various challenges in provision of laboratory instruments in public secondary schools. The finding is in agreement with Oduro (2009) that challenges facing principals in provision of laboratory instruments include dealing with low motivation, managing class sizes, dealing with inadequate resources and managing with fewer funds. Inadequate finances to equip laboratories pose a great challenge to principals thus the need to partner with other stakeholders to outsource funds for equipping laboratories.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter presents a summary of the major findings of the study and giving conclusions which attempt to give answers to specific questions that were investigated. It also presents recommendations for possible actions and suggestions for future research.

Summary

Findings established that laboratory instruments in the study area were inadequate as indicated by 68% of the respondents where by the chemistry laboratories were very inadequate as indicated by 43.5%, biology laboratories were inadequate as indicated by 48%, physics laboratories were inadequate as indicated by 56.5% and computer laboratories were very inadequate as indicated by 65.2% of the respondents. Findings also established that teachers lacked improved teachingaids as indicated by 62.5% and the students indicated that the laboratories were not enough as indicated by 62%. Laboratory is essential to the teaching of physicssand the success of any physics course is much dependent on the laboratory provision made for it and

lack of well- equipped laboratories affect students' performance in physics subjects.This finding concurs with Balogun (2018) that no effective physics education programme can exist without instruments and equipment for practical teaching like laboratories. Findings established that teachers make use of the laboratory instruments in teaching physics subjects to a great extent as indicated by 50.5% of the respondents whereby teachers allow students to take physics subjects in the laboratory frequently as indicated by 43% of the respondents. Using laboratories in teaching and learning of physics and other physics related disciplines helps students to understand and recall what they see than what they hear or were told in theory. This finding differs with Shy man sky and Penick (2019) who asserted that teachers do not engage students in laboratory activities in ways that are likely to promote the development of physics concepts.

The findings revealed that there is a relationship between laboratory instruments and students' academic performance as indicated by 51.2% whereby availability of well-equipped laboratory instruments affect performance of students in physics subjects since laboratory work stimulates learners' interests as they are made to personally engage in useful scientific activities and experimentation; promotes that physics is not only product or

process; affords the learner the basic skills and scientific method of problem solving and knowledge obtained and promotes long termmemory. This concurs with Soyibo and Nyong (2022) that schools with well- equipped laboratories have better results in the school certificate physics examinations than those that are ill-equipped and lack of adequate exposure to practical work is one of the contributing factors to dismal performance in examinations.Findings also established that principals face challenges in provision of laboratory instruments which include inadequate resources to equip laboratories as indicated by 87% of the respondents, lack of qualified laboratory instructors as indicated by 78.3%, insufficient competent and qualified physics teachers as indicated by56.5% and managing class sizes as indicated by43.5% of the respondents. This is in agreement with Oduro (2009) that challenges facing principals in provision of laboratory instruments include dealing with low motivation, managing class sizes, dealing with inadequate resources and managing with fewer funds.

Conclusion

It was concluded that public secondary schools in Machakos Sub-County have inadequate chemistry, biology, physics and computer

laboratories and the schools that have enough laboratories lack equipment and competent physics instructors. Laboratory is very crucial to the teaching of physicss and the performance of any physics subject depends on the laboratory provision and lack of well- equipped laboratories affect student' performance in physicss.

It was also concluded that the frequency of teachers teaching physics subjects in laboratories and also allowing students to use laboratories frequently help improve their academic performance in the physics subjects. Engaging students in laboratory activities promotes the development of physics concepts.

The study established that there is a significant relationship between availability of laboratory and students' performance in physics since laboratory equips students with practical skills which help them to remember what they are taught in theory thus improving their performance in physics subjects examinations. Schools with well-equipped laboratories have better results in the school certificate physics examinations than those that are ill-equipped.

The study also established that principals face challenges in provision oflaboratory instruments which includes managing funds so as to equip laboratories, incompetent teachers and laboratory instructors and managing the big class sizes intended to use the few laboratories.

Recommendations

Based on the findings of this study, the researcher makes the following recommendations:

- Principals should work hand in hand with parents, sponsors and other stakeholders in education to prioritize the provision of adequate laboratory instruments to ease the problems of inadequacy of laboratories in public secondary schools.

- Physics teachers should be encouraged and motivated to use physics laboratories more frequently. Physics teachers should also be taken to workshops and in-service training to make them more competent in teaching physicss subjects theoretically and practically. This could trigger teachers' creativity and innovation in the use of laboratory equipment in teaching and learning process.

- Students should be given more opportunities to experience physics by

being exposed to more laboratory practicals which may enhance better performance in physics subjects.

- The government should provide some laboratory equipment to schools to subsidize their costs and encourage the local chemical manufacturers to Produce more affordable chemicals and laboratory equipment.

5.5 Suggestions for further study

Given the scope and limitations of this study, the researcher recommends the following as areas for further studies:

i. Similar studies could be carriedoutinothercountiestoestablish whether ornot the findings of this study apply to other areas.

ii. Similar studies focusing on performance of physics subjects topic wise in order to diagnose the specific areas that need to be given more attention and this will enabletheeducators to knowtheareas which are not well covered.

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