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Factors Affecting Conduct of Practical Activities in Science Subjects in Some Selected Secondary Schools in Tarauni Local Government Area, Kano State

A.S. Ado[1*], S.A. Hussain[2], M. Muzammil[3], F.S. Gwarzo[4]

[1,2]Dept. of Biology, School of Science Education, Sa'adatu Rimi College of Education, Kumbotso, P.M.B. 3218 Kano State, Nigeria
[3]Dept. of Integrated Science, School of Science Education, Sa'adatu Rimi College of Education, Kumbotso, P.M.B. 3218 Kano State, Nigeria
[4]Dept. of Biological Sciences, Kano State College of Education and Preliminary Studies, Kano State, Nigeria

[*]*Corresponding Author: saboadoabdullahi9@gmail.com,*

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***Abstract*—**Developing scientifically literate individuals who are highly competent in logical thought and action is the main objective of science education. The objectives of science education in Nigeria include preparing students to observe and explore their surroundings, to explain basic natural phenomena, to develop scientific attitudes like curiosity, critical reflection, and objectivity, to use their scientific knowledge and skills to solve environmental problems on a daily basis, and to build their self-confidence and independence through problem-solving activities in science. Numerous studies have proved that science students struggle to understand the subject, and these learning challenges have branded some areas as challenging. In the study, 291 students from 10 secondary schools in the Tarauni local government area of Kano state were purposefully selected. The study identified factors related to teachers, laboratory-related factors, and learners' perceptions of factors influencing the conduct of practical activities using a descriptive survey research design. Data from the respondents was gathered using instrument titled Factors Affecting Conduct of Practical in Science Questionnaire (FACPSQ). Descriptive statistics (frequencies and percentages) were used to analyse the data obtained. The findings indicated that teacher-related factors that affect how science practical are conducted include lack of management motivation and awareness, full-time occupancy of science teachers, low commitment from teachers to practical classes, teacher absenteeism, teachers' lack of knowledge about practical work and low qualifications for science teachers and laboratory attendants. Findings showed that inadequate laboratory equipment, inadequate time assigned for practical activities, a lack of practical textbooks, an incompetent lab assistant, and inefficient instrument maintenance were laboratory-related factors that significantly impacted practical activities in science. The result also demonstrated those students' perceptions that affected scientific practical included: more students than equipment; a hazardous laboratory atmosphere; and a lab assistant who lacked motivation. Based on the findings, teachers-related factors, laboratory-related factors, and students' attitudes toward laboratory activities all have an impact on how science practical activities are carried out. The study suggested that, in order to ensure that practical work is carried out effectively, practical time should be allotted on the school schedule, and regular classroom monitoring should be carried out. There should be enough basic necessities on hand. Additionally, science teachers must carefully plan adaptive teaching methods for their students that will stimulate their interest in learning science and help them apply what they have learned to meet societal requirements.

Keywords—laboratory, learning, performance, practical, science, teaching.

I. INTRODUCTION

A country's level of development is determined by how many human resources it has produced through a well structured educational system, not how many buildings, roads, or bridges it has built [1]. Education has been defined and conceptualized by a wide range of philosophers, fiction writers, and educationalists. Education includes the development of a student's moral, physical, emotional, and intellectual fortitude in order for him to contribute to societal reform as well as the learning of natural laws and the skillful application of them to the wellbeing of the person [2]. The art of employing information for a full life is also a part of education. Education is the process of acquiring knowledge and ideas that shape and affect a person's viewpoint, actions, and accomplishments [3].

The systematic pursuit and application of knowledge and understanding of the social and natural worlds through evidence-based methods is what is known as science [4]. Science is a subject of study that is vital to advancement due to its connections to technology and business. Scientific progress is necessary for improving life quality,

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the long-term development of the planet, and harmonious human coexistence [5]. Science provides the framework for action at the local, regional, national, and transnational levels, from the most basic needs of life, such as water, food, and shelter, to more complex issues, such as agricultural production management, water resources, health, energy resources, biodiversity, conservation, the environment, transportation, and communication [6]. Science and technology have been regarded as significant forces behind economic progress, long-term social development, and a change in the country's landscape that may result in industrialization [5]. Reference [4] claimed that science involves a variety of methods or methodologies, such as objective observation (Measurement and data, possibly but not necessarily using mathematics as a tool); evidence; experiment and/or observation as benchmarks for testing hypotheses; induction (reasoning to establish general rules or conclusions drawn from facts or examples); repetition; critical analysis; verification and testing; and inference (critical exposure to scrutiny, peer review and assessment).
The subject of study known as science education exposes students to both the content and the methods (processes) of learning scientific information for practical application [7]. For various people, science education can mean different things, but one thing is certain: it combines scientific knowledge with educational research. In light of this, science education includes both the learning of scientific knowledge and the education necessary to share it with others who aren't generally interested in science [8]. In the never-ending pursuit of knowledge, it is the application of educational (learning) theories, especially those based on philosophical, sociological, and psychological perspectives, leading to the development of intellectual and psychomotor domains through methodical procedures involving careful observation, deduction, and empirical testing [9]. On the other side, science education is the study of biology, chemistry, or physics along with a teaching strategy in order to communicate scientific knowledge to people or communities [10]. When technical content from biology, chemistry, or physics lectures is omitted, scientific education is condensed to only science [7-8]. Science education must to be able to impart scientific concepts while also clearing up students' misunderstandings of them [8].

Despite the value of science education to the advancement of society and the economy, teaching science without the use of practical activities and instructional materials may undoubtedly lead to unsatisfactory academic performance [11]. According to [12], there aren't enough acceptable instructional materials available in schools to effectively teach science. Insufficient use of instructional resources and demonstration methods for science teaching and learning, poor facility conditions, large class sizes, ineffective instruction, improper assessment practices, and a lack of qualified teachers are all contributing factors to students' poor performance in science [11]. The poor condition of laboratory facilities and the insufficient utilization of teaching materials have created issues for students' performance in science on the Senior School Examination [13]. The verbal exposition does not encourage the development of skills, objectivity, and critical thinking that will help the child operate well in society, this contributes to students' low academic performance [14]. Poor academic performance may emerge from the teaching of science subjects without practical exercises and instructional resources [15]. According to [16-18], a professionally qualified science teacher no-matter how well-trained, would be unable to put his or her theories into practice if the school environment lacked the tools and materials required for them to turn their competence into reality. In view of the above, the study aimed to determines factors that affect the conduct of practical activities in science subjects in some selected secondary schools of Tarauni local government area, Kano state.

I.I Objectives of the Study

The main objectives of this study are;

1. To determined the Teachers' related factors influencing conduct of practical work in science subjects in some selected secondary schools in Tarauni.
2. To identify laboratory related factors influencing conduct of practical work in science subjects in some selected secondary schools in Tarauni.
3. To highlight the learners' perceptions towards factors affecting the conduct of practical work in science in some selected secondary schools in Tarauni.

I.II Research Questions

The following research questions will be implied;

1. What are the Teachers' related factors influencing conduct of practical work in science subjects in some selected secondary schools in Tarauni?
2. What are the Laboratory related factors influencing conduct of practical work in science subjects in some selected secondary schools in Tarauni?
3. What are the learners' perceptions towards factors affecting the conduct of practical work in science in some selected secondary schools in Tarauni?

III. METHODOLOGY

III.I Research Design

The researcher used descriptive survey research design to assess the factors that affect the conduct of practical on academic performance in Science among secondary school students in Tarauni, Kano state. Survey research design is a type of research in which information is gathered from a representative sample using a questionnaire and utilized to describe the characteristics of a population. In the context of this study, this includes gathering information from a sample of a target group and extrapolating the findings to the entire population; this is in line with the fundamental principles of survey design.

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III.II Population and Sampling Techniques

The totality of all potential respondents makes up the study population, from which a sample is drawn. This implies that individuals focus on the complete event, object, or group of people being examined over a set length of time for a particular research objective. 811 Science students from selected secondary schools in the Tarauni local government area of Kano make up the study's population. The researcher used science students at all levels from selected schools as a sample of the population that served as a representation of the full population. Using Krejcie and Morgan's table [19], the current study's proper sample size was 291 students from all levels, who adequately reflect the total population. The respondent for the study was chosen using stratified and straightforward random sampling methods.

III.III Data Collection Instrument

The questionnaire "Factors Affecting Conduction of Science Practical Questionnaire (FACCPQ)" was developed by the researchers and evaluated by other specialists and utilized as the instrument for data collection in this study. For the purpose of gathering information from respondents, the researchers formulated and employed a Likert-type rating scale that was separated into two sections. While section "B" was made up of 16 questions items divided into parts, section "A" contains socio-demographic data about the respondents.

III.IV Method of Data Analysis

After the questionnaires were completed, the raw data was cleaned, sorted, and entered into a statistical data entry form made in the Statistical Package for Social Sciences (SPSS) program for analysis in line with the study's objectives. Data was presented using frequency and percentage.

IV. Results and Discussion

IV.I Socio-Demorgraphic Information of the Respondents

The demographic information of the respondents on the age is presented in the **Figure 1** below. From the Figure, it shows that 178(61.2%) of the respondents were between the age of 14-16years. Whereas, 91(31.3%) of the respondents were between the age of the 17-19years. Of the 291, 15(5.2%) and 7(2.4%) of the respondents were 20-22 and 23-above years respectively. This revealed that majority of the respondents were between the ages of 14-16years. With regard to students level or class, 113(38.8%), 102(35.1%) and 76(26.1%) of the respondents represented SSI, SSII and SSIII respectively. **Figure 2** show that, students from SSI dominated the study. The results also showed that 155(53.3%) and 136(46.7%) of the respondents were male and female respectively. This indicated that majority of the respondents are male (**Figure 3**).

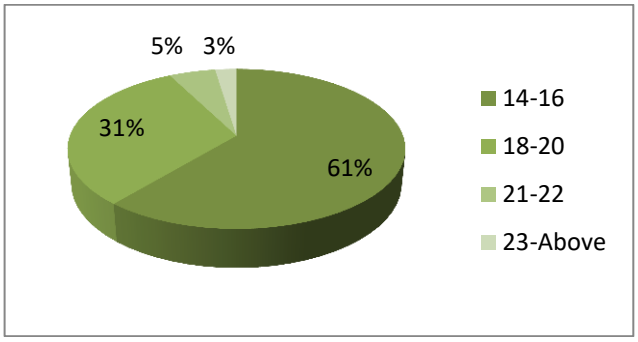

Figure 1: Age Distribution of the Respondents

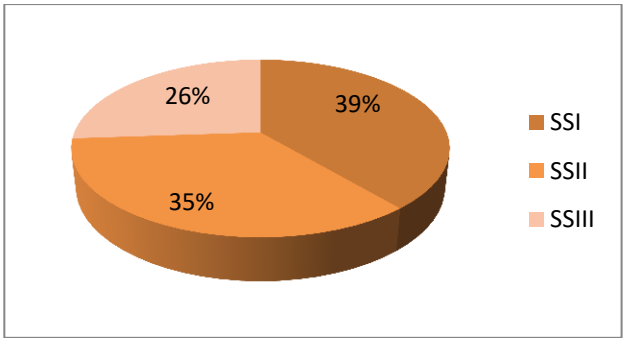

Figure 2: Class Distribution of the Respondents

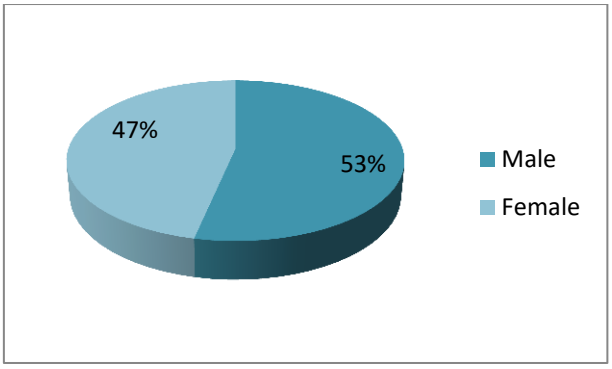

Figure 3: Gender Distribution of the Respondents

IV.II Teachers' Related Factors on Influencing Practical Activities

The questionnaire utilized a four-point Likert scale in which the respondents were required to give their views: strongly agree (SA), agree (A), Disagree (D) or strongly disagree (SD). In order to gather the views of the respondents on teachers' factors that influence practical work in science the respondents were required to indicate their views. As shown in **table 1**, the majority of respondents (54.6% and 40.2%) claimed that the lack of awareness and motivation of school managements to practical work is the major factor that influences practical work in science. 43.6%, 47.1%, 46.4%, 40.2% and 50.2% of the respondent claimed that the full-time occupancy of science teacher, low commitment of teachers for the practical classes, absenteeism of teachers' from practical class, teachers poor knowledge about practical work and low qualification of chemistry teacher are influencing practical work in science of secondary schools, respectively.

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Table 1: Respondents View on Teachers'-Related Factors Influencing Practical Work

RESPONSES	SA	A	D	SD
Teachers' poor knowledge of practical work	117(40.2%)	136(46.7%)	23(7.9%)	15(5.2%)
Low qualification of science teachers	146(50.2%)	73(25.1%)	46(15.8%)	27(9.3%)
The full-time occupancy of science teachers	127(43.6%)	101(34.7%)	15(5.2%)	48(16.5%)
Absenteeism of teachers from practical class	64(22%)	135(46.4%)	47(16.2%)	45(15.5%)
Low commitment of teachers for practical classes	110(37.8%)	137(47.1%)	23(7.9%)	21(7.2%)
Lack of awareness and motivation of school management	159(54.6%)	117(40.2%)	11(3.8%)	9(3.1%)

IV.III Laboratory Related Factors on Influencing Practical Activities

In order to gather the views of the respondents on laboratory factors that influence practical work in science, the study used similar instruments same as above to collect information from the respondents. **Table 2** shows the responses of the respondents. Out of the total 291 respondents, the majority (45.4%, 69.1% and 50.5%) replied that the possible laboratory-related factors influencing practical work in science are lack of types of equipment in the laboratory, too short period allocated for the practical activities and lack of practical textbooks (manual) in the secondary schools respectively. Furthermore, 59.1% and 54.6% of the respondents claimed that the lack of competent laboratory attendant and ineffective maintenance of laboratory instruments are influencing the practical work (**Table 2**). Laboratory has been given a central and distinct role in science education to conduct practical activities in science. However, the findings are indicating a lot of concern has been shown about the inadequacy of science laboratory in Tarauni local government area.

Table 2: Respondents View on Laboratory-Related Factors Influencing Practical Work

ITEMS	SA	A	D	SD
Lack of equipment in the laboratory	132(45.4%)	71(24.4%)	52(17.9%)	36(12.4%)
Lack of practical text book (manual)	75(25.8%)	147(50.5%)	72(24.7%)	15(5.2%)
Lack of competent laboratory scientists, technicians and attendants	172(59.1%)	31(10.7%)	71(24.4%)	17(5.8%)
Ineffective maintenance of laboratory	159(54.6%)	92(31.6%)	29(10%)	11(3.8%)
Too short period for practical work	201(69.1%)	68(23.4%)	13(4.5%)	9(3.1%)

IV.IV Learners-Perceptions Toward Factors Influencing Practical Activities in Science

In order to answer the question that asked "learners' perceptions towards factors affecting the conduct of practical work in science in some selected secondary schools in Tarauni", data collected were presented in table below. As shown in **Table 3**, majority of respondents (19.2% and 59.5%) expressed their view as disagree and strongly agree to the statements, that Students' population is larger than the available apparatus during science practical class. The respondents strongly agreed to the statements, such as school managements paying less attention toward practical work (41.6%), science teachers and laboratory attendant do not encourage them to practical work (38.1%). Moreover, the majority of respondents agreed with the statements such as their intelligence level cannot cope with science practical activities (54.6%) and there is unsafe laboratory environment to conduct practical classes (37.1%).

Table 3: Learners-Perceptions towards Factors Influencing Practical Work in Science

ITEMS	SA	A	D	SD
Science teachers and laboratory attendant do not encourage students toward practical work	111(38.1%)	70(24.1%)	87(29.9%)	23(7.9%)
Students' population is larger than the available apparatus during practical class	173(59.5%)	53(18.2%)	56(19.2%)	9(3.1%)
Unsafe laboratory environment to conduct practical classes	28(9.6%)	108(37.1%)	72(24.7%)	83(28.5%)
School managements paying less attention to practical work	121(41.6%)	47(16.2%)	45(15.5%)	78(26.8%)
Students' intelligence level cannot cope with practical activities	92(31.6%)	11(3.8%)	159(54.6%)	29(10%)

IV.V Discussion

Science practical work serves a variety of objectives, including as honing abilities, expanding one's scientific knowledge and comprehension, and learning the methods used in scientific investigation. It has the potential to

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support deep scientific learning [20]. The findings indicated that the measurements required, the lack of motivation and awareness on the part of school administration, the full-time employment of science teachers, the low commitment of teachers to the practical classes, the teachers' absenteeism from the practical classes, the teachers' lack of knowledge about the practical works, and the low qualification of science teachers/attendants are all factors that threaten the practical works in science of secondary schools in Tarauni local government area (**Table 1**). This study is in line with the report by [21] who highlighted a number of factors that had an impact on the implementation of practical work in schools. Their research revealed a lack of funding for equipment, a lack of comprehension of the goals of the science curriculum changes, a lack of time and resources for practical work, a lack of mentorships for inexperienced teachers to help them gain confidence in practical work, and a lack of opportunities for professional development and training. Furthermore, the results of this study are consistent with those of [22] who found that few secondary schools have science laboratories and that those that do often have outdated equipment and materials. These factors can have a significant impact on how teachers teach science practical.

In order to conduct practical science activities, the laboratory has been assigned a central and distinct role in science education. There may be laboratory-related factors that affect practical work in science, including a lack of equipment in the lab, a lack of time allotted for practical activities, a lack of practical textbooks (manual), a lack of a qualified lab assistant, and ineffective maintenance of lab equipment. However, the results suggest that there has been significant concern expressed regarding the Tarauni local government area's inadequate science laboratory. Laboratory work is significant in science education and it also contributes in learning the distinction between observation and data presentation [23]. Reference [24-25] noted that laboratory work is essential for learning about the sciences, but that there are some issues that arise, including a lack of supplies for the necessary experiment, a lack of knowledge about the techniques to be used during the experiment, a lack of glassware and chemicals, a lack of safety procedures to prevent accidents, and more.

The data seen in **Table 3,** revealed that the student population during science practical classes is higher than the equipment that is available, and that the unsafe laboratory environment used to conduct practical classes has an impact on students' perceptions of practical work in science subjects. The responses from the students support their teachers' beliefs that the students have a negative attitude toward scientific practical work because their attitude is impacted more by the physical resources in general than by their enthusiasm in practical work. According to [26], teachers play critical roles in fostering educational growth and performance, and their qualifications, subject-matter expertise, enthusiasm, interactions with students, lecture delivery style, and motivation of discussion participation have a positive and significant impact on students' accomplishments. Heinesen [27] argued that instructors' teaching methods help students better understand the concepts they are being taught, and that their skill and competence as teachers have a major impact on students' performance. Physical resources and staff competency are crucial in influencing how well students succeed [28].

V. CONCLUSION AND FUTURE SCOPE

It can be said that teachers' lack of practical knowledge, their full-time commitment to theoretical classes, their absence from practical classes, the lack of awareness and motivation on the part of school administration, and unsafe working conditions in the classrooms are all factors related to teachers that have an impact on science practical work. Lack of equipment in the lab, the inadequate amount of time allotted for practical work, and students' negative attitudes toward practical work in scientific classes are all factors related to the laboratory. Therefore, teachers should create activities that include students in scientific investigations that keep their attention on the task and its outcome in order for practical work to be effective in providing meaningful science teaching and learning. In order to improve students' technological applications, science education in secondary schools should help students build the fundamental scientific skills. Teachers and school administration must adopt a constructive attitude toward practical work in secondary school.

Based on the findings of the study the following recommendations were made; It is important to start and maintain in-service teacher training that prioritizes the use of hands-on activities in teaching and learning. School laboratories should be built, furnished, and maintained using government funds for education. Create and implement comprehensive practical frameworks, a vitally important thorough action plan, and any necessary supporting materials like practical teaching manuals and teacher's guides. To ensure that practical work is carried out effectively, it should be allocated on the school timetable, and regular supervision should be carried out in the classroom. There should be enough practical needs on hand and Science teachers must carefully plan adaptive activities for students that stimulate their interest in science learning and make use of the skills they have acquired to meet societal demands.

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