EFFECT OF LABORATORY FACILITIES ON STUDENTS' ACADEMIC PERFORMANCE IN SECONDARY SCHOOLS BASIC SCIENCE IN AFIJIO LOCAL GOVERNMENT AREA OF OYO STATE

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Abstract

This study investigated the effect of laboratory facilities on the academic achievement of basic science students in selected secondary schools. The purpose of this research work is to examine the effect of laboratory facilities on students' academic performance in Basic science in Afijio Local Government. The study employed a pre-test and post-test quasi-experimental research design with (40) forty students randomly selected from different schools. Basic Science Achievement Test (BSAT) from NECO was used for data collection. The Analysis of Covariance (ANCOVA) was used to compare the differences between the achievement of the experimental and control groups in pre-test and post-test at a 0.05 level of significance. The findings of the study revealed that there was a significant difference between the students who were exposed to laboratory facilities and those exposed to the conventional scheme in basic science achievement, where $p<0.05$ level of significance. Therefore, those students taught with the effective utilisation of science laboratory equipment achieved better than those taught with the conventional method in Basic science. The study concluded that active utilisation of laboratory facilities significantly influences the academic achievement of students in Basic science.

Keywords: Laboratory, Conventional, Achievement, Equipment, Laboratory facilities

Background to the study

Science is very important in the development of any nation. One of the ways of appreciating science teaching and learning is through effective laboratory instruction. The laboratory has long been a distinctive feature in science education. Its introduction has proved successful because students will go out from the laboratories and be able to "see and do" Hoftein and Lunetta (2019). Laboratory activities and availability of equipment allow students to think logically, ask reasonable questions, seek appropriate answers and solve problems. Moreover, the availability and utilisation of laboratory equipment and facilities in teaching make science lessons concrete, stimulating and help to enhance the achievement of students.

The teaching laboratory is the standard method of training students in the skills and values central to scientific investigation and important in the development of a positive attitude to science. At the science laboratory, students work cooperatively in small groups to investigate phenomena. This mode of instruction has the potential to enhance constructive social interactions as well as positive attitudes and academic performance. Even though the knowledge of science in society is very important. Rost and Feng (2024) stated that academic self-concept strongly predicts achievement in science subjects.

Laboratory learning environment and availability of learning resources enhance students' performance in the subject. Science laboratory as a unique learning environment, is a setting where students can work cooperatively in small groups to investigate scientific phenomena. The environment in a laboratory is expected to be less formal when compared to the conventional classroom setting and presents opportunities for more interactions between students and with the teacher as well. Such interactions are likely to promote more positive social interactions that are ideal for creating a constructive and positive learning environment (Hofstein, Nahum and Shore, 2019). Although teachers and students share the same learning environment, it is likely that their perceptions of such a learning environment differ. The nature of science laboratory learning environment can make a difference on how students are motivated to achieve their set goals. The physical environment of the laboratory in terms of facilities, space, lighting, ventilation, workbenches, and stools in the laboratory influences the safety and comfort of students and also students' attitudes towards a particular subject and the learning of a subject. It can also influence the personal development of students. The laboratory learning environment in which science teaching and learning occur is therefore likely to have a major influence on students' learning outcomes and have a positive impact on science teaching and learning.

According to Mokoro, (2020), laboratory facilities play a significant role in determining curriculum implementation effectiveness. Teachers' use of these facilities is therefore the key factor to influencing the curriculum implementation outcomes and in cases of their shortfalls, the teachers could only improvise to achieve desired objectives

A laboratory is a facility that provides controlled conditions in which scientific or technological research, experiments, and measurement may be performed. Laboratory tools refer to the various tools and equipment used by scientists working in a laboratory. The classical equipment includes tools such as safety equipment, balances, skeletons, ring stands with rings attached, burettes, thermometers, volumetric flasks, crucibles, funnels, and graduated cylinders. A well-equipped laboratory provides a forum where the learner is allowed to subject their beliefs, ideas, statements, theoretical preposition and so on to some experimental test through practical experimentation. In this regard, it is to be noted that a school laboratory is a facility situated within the school environment used especially for students' teaching and the demonstration of classroom practices. It is also referred to as a special facility within the school where experiments are done and typically contains equipment, beakers, burners and other tools necessary to complete experiments. For effective teaching and learning to be enhanced and for students' academic performance to be improved, these tools must be adequately provided and effectively utilised. It refers to the condition of being obtainable or accessible at a particular point in time. It expresses how materials can easily be obtained and used for a particular purpose and time. It also states how usable resources are upon demand to perform its designated or required functions. In this study, availability means the condition under which teachers have access to and make use of functional instructional materials for effective teaching and learning. It refers to the quality, quantity, functionality and disposability of such instructional materials to teachers at every point in time for effective utilisation. As a concept, it is an umbrella term that denotes the serviceability, resilience, reliability and maintainability of a component instrument. It is vital to note that the development of education in any society, irrespective of its level, depends largely on the availability

and adequacy of instructional materials. Spreitzer and Hafner (2023) identified school quality and learning environment as key predictors of student achievement.

From the foregoing, it can be argued that the report on poor performance of students in science at the secondary school level might be due to both students' perception of the laboratory learning environment and the failure of teachers to conduct laboratory activities in a way that will make students more active participants in science teaching and learning situations. The poor performance in science is a reflection of the inadequacy inherent in the laboratory learning environments at the school level. It also appears from the review of available literature that the availability of laboratory facilities on students' learning outcomes in secondary school science classes has not been extensively looked into in Nigeria. This paucity of literature in this regard gives room for the need to conduct an empirical study on science laboratory facilities. The focus of the present study, therefore, was to investigate laboratory facilities and secondary school students' academic achievement in Basic science.

Statement of the Problem

In recent times, poor performance of students in science has generated serious concern among science educators. Consequently, researchers have worked on several causative factors, such as teachers' qualification, students' inability to acquire some basic science process skills, learning environment, class size and parental involvement in child education and so on. In an attempt to address the problem, some studies have been carried out through the use of carefully planned instructional strategies and models to improve the status of science teaching and learning.

Despite all these efforts, students' performance in science has remained consistently poor at secondary school levels and according to Bolanle and Abiodun, (2026) stated that, the availability and effective utilization of laboratory facilities significantly improve students' performance in science subjects at the secondary school level. Poor provision or underuse of laboratory facilities is strongly linked to low achievement in subjects like Chemistry and Biology. All these strategies gave a little improvement over the conventional teaching method, which is being used in our secondary schools. However, there seems to be a neglect of other important factors, such as laboratory facilities. Hence, this study is to fill the existing gap.

Hypothsseses

H_{01}: There was no significant difference in the post-test achievement scores of students exposed to laboratory practical and those taught using the conventional method for their pre-test scores in basic science.

Research Question

1. There was no significant difference in the achievement of students in Basic Science

between those who adequately utilised laboratory equipment and those who did not.

Review of Related Literature

This study adopted the theory of constructivism of Piaget because the theory holds that learners interact with their environment to develop complex reasoning and knowledge. Learners interact with objects in their learning environment such as laboratory facilities, through experiment and manipulation, the learners become intrinsically motivated, which tends to positively influence their learning and the development of new skills. Adequacy of laboratory facilities is a situation in which there is enough laboratory equipment for effective utilisation in the teaching and learning of science subjects such as biology,

chemistry, agricultural science, physics, mathematics etc. The adequacy of laboratory equipment is determined by the total number of students enrolled in schools. Ajayi and Ogunyemi (2021) reiterated that when facilities are provided in adequate quantity to meet the relative needs of a school system, students will not only have access to the reference materials mentioned by the teacher, but individual students will also learn at their own pace. Ogunkunle (2020), noted that when concrete materials are used by students, they can solve problems which they are naturally limited to solve and can enable students to improve their academic achievements. The net effect of this is increased overall academic performance of all students. On the contrary, inadequate facilities and equipment in teaching are the origin of failure. Adams and Lunga (2022) observed that the availability of laboratory equipment in schools benefits the student in related examination performance. The learners themselves are resources to a resourceful teacher. The teacher can utilise their innate skills and ingenuity in producing certain local materials to be used as teaching aids. Even though practical work is a unique source of teaching science, it is widely acknowledged that laboratory equipment is lacking in most schools (Omosewo, 2017). It is therefore the interest of the researchers to find out whether laboratory facilities determine secondary school students' science learning outcomes in the Afijio Local Government area of Oyo State.

Methodology

The research design used in this study was a pre-test, post-test, control group quasi experimental design. The population of this study was made up of all secondary school students in Afijio Local Government Area of Oyo State. The sample was made up of 40 JSS2 students selected by using stratified sampling technique. The instrument used in data collection was a Basic Science Achievement Test (BSAT). BSAT has Section A contains personal data and Section B contains 20 multiple choice items. The instrument was developed to test the knowledge of students in the area of Basic science. The reliability of the Basic Science Achievement Test was determined using the Kuder-Richardson Formula 21 (KR-21). A reliability coefficient of 0.70 and above was considered acceptable for the study. The instruments were subjected to both face and content validity using NECO examination questions. The data collected were analysed using mean, standard deviation for answering research questions and Analysis of Covariance (ANCOVA) was used for testing the hypotheses at 0.05 level of significance.

Results and Discussion of Findings

H_O1: There was no significant difference in the post-test achievement scores of students exposed to laboratory practical and those taught using the conventional method for their pre-test scores in basic science.

Table 1: ANCOVA analysis of pre-test ansd post-test achievement scores in Basic Science

Source	Sum of Square	Df	Mean quare	F	Sig
Corrected	7124.07	2	5112.44	67.05	0.00
Intercept	15018.676	1	16018.88	420.10	0.00
Pre test	5452.804	1	4752.80	107.68	0.00
Method	1904.678	1	1704.78	39.93	0.00
Error	2585.273	59	46.78		
Total	45202.000	65			
Corrected Total	**9520.233**	**61**			

$p<0.05$ level of significance

Table 1 above revealed that there was a significant difference in the post-test achievement scores of students exposed to laboratory practical and those taught using the conventional method for their pre-test scores in basic science, where $p<0.05$ level of significance; therefore, the null hypothesis is rejected. This was in line with (Bryson (2020) who argued that practical work helps to improve students' scientific knowledge. Practical work is essential to teaching and learning in the field of science and good quality practical work helps develop students' understanding of scientific processes and concepts. Schwichow (2016), argued that students achieved a deeper level of understanding by finding things out for themselves and by experimenting with techniques and methods that have enabled the secrets of our bodies, our environment, and the whole universe to be discovered. Practical work has been able to promote students' positive attitudes and enhance motivation for effective learning in science. (Okami and Zakari, 2017). Also, Adams and Lunga (2022) indicated that providing laboratory experimental study materials in schools enhanced students' achievements through hands-on experiment (SHE) or a teacher-based demonstration experiment (TBDE) approaches significantly improved academic performance of students The findings of Ogunkunle, (2020) also showed that simulated laboratory (SL) and enriched laboratory guide material (ELGM) experiments, affected the achievement in basic science of male and female students with different future career interests in science.

Table 2.

There was no significant difference in the achievement of students in Basic Science between those who adequately utilised laboratory equipment and those who did not.

Pre-test and post-test of students' achievement based on the utilisation of laboratory equipment

Group	N	Pre(X1) test	S.D	Post(X2) test	S.D	Mean score
Experimental	20	46.67	24.57	54.80	23.40	27.25
Control	20	20.45	10.56	23.78	9.78	12.48

This shows that the mean score for students taught Basic science with effective utilisation of science practical equipment was 27.25, while the students taught with the conventional method was 12.48. Therefore, those students taught with effective utilisation of science laboratory equipment achieved better than those taught with the conventional method in Basic science and according to Dillon (2018), there are many reasons for doing practical work for scientific subjects in schools. Some of the reasons are to encourage accurate observations and descriptions, to change theories into real-life applications, to keep the interest of students in scientific studies and promote a logical and reasoning method of thought. Musa and Umar, (2017), found that biology laboratory facilities are either not available entirely, or where they are available, they are inadequate and therefore they are not utilised by the high number of students. The main role of practical work is to give support for students in their learning and to make a link between the domain of real objects and observable facts on one hand and the domain of ideas on the other (Bryson et al., 2020). On the other hand, Muhammad and Ahmad. (2023) also reported that the availability of laboratory equipment and utilisation positively influence basic science achievement. Okam and Zakari (2022) concluded that there is a

relationship between the availability of science laboratories and the performance of students in Upper Basic Schools in Kwara State, Nigeria. Iyinade, (2024) also stated that the availability and proper use of laboratory facilities significantly improve students' academic achievement in Basic Science. This aligns with findings that laboratory exposure enhances understanding and performance.

Conclusion

The study concluded that practical work is essential to teaching and learning in the field of science and laboratory facilities help in the development of students' understanding of scientific processes and concepts. Therefore, government at all levels must focus attention on the provision of laboratory facilities in public secondary schools. Students' learning outcomes are statements that specify what students would know or would be able to demonstrate as a result of the completion of a learning process. Laboratory facilities significantly affect the academic achievement of students in Basic science. Schools with well-equipped laboratories tend to record higher achievement levels, improved practical skills and greater interest in science subjects compared to those with inadequate or poorly maintained facilities. Therefore, laboratory resources are not just supplementary but essential for effective science teaching and learning in secondary schools.

Recommendations

Government and school authorities should prioritize the establishment and maintenance of functional science laboratories in all secondary schools. Increased budgetary allocation should be directed toward equipping laboratories with modern tools, chemicals, and apparatus. Science teachers should be regularly trained on effective laboratory management and innovative teaching methods that integrate practical work.

Schools should encourage students to actively participate in laboratory activities to build confidence and deepen their scientific knowledge. Local communities and stakeholders should collaborate with schools to provide additional resources and ensure sustainability of laboratory facilities. Education authorities should periodically assess the state of laboratories and their impact on students' performance to guide policy decisions.

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