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Relationship between availability of laboratory materials and students' academic performance in chemistry in Kilifi North Constituency, Kenya

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Abstract

Even though chemistry is the foundation and gatekeeper of other science courses, high school students across continue to score poorly in the subject overall. The purpose of the study was to determine how the performance of learners in chemistry was related to the availability of chemistry lab materials. Kilifi North Constituency was the site of the study. Six mixed schools were chosen using simple random sampling, one school for girls and boys were chosen using purposive method. Eighty students were chosen using simple random selection and stratified random sampling. Eight chemistry teachers were sampled using basic random sampling and purposeful sampling. The Chemistry Teacher Questionnaire (CTQ), Student Questionnaire (SQ), Observation Checklist (OC), and document and mark sheet analysis were used to gather data. Ten students and two teachers participated in the pilot project which was conducted at two schools in the Kilifi North Constituency. Data analysis was made simplified with the use of the Statistical Package for Social Sciences (SPSS). The study variables were presented using descriptive statistics such as frequency tables, mean, and percentages. Hypotheses at .05. were tested using inferential statistics (Spearman's Rank order correlation and Pearson product moment of correlation coefficient). The study revealed that 75% of schools had laboratories, with a significant correlation ($r = 0.819$, $p = 0.013$) between the availability of laboratory materials and students' academic performance in chemistry practical's, accounting for 67.08% of the variability in scores. Additionally, the majority of chemistry apparatus and chemicals were deemed sufficiently available, indicating overall adequacy in laboratory resources for effective teaching and learning. The study recommended that Schools should improve laboratory facilities by assuring the availability of necessary equipment and chemicals, as well as offering teacher training, in order to maximize resource efficiency and increase student chemistry performance.

Keywords: Chemistry Laboratory; Academic Performance; Educational Stakeholders; Experiment; 8-4-4 System

1. Introduction

Considering chemistry as a science is concerned with concepts related to the behavior of matter, factors that impede good performance in the subject will always be of major importance to educational stakeholders (Abamba et al., 2021; Abdullahi et al., 2019). Even if some of the ideas covered in chemistry classes are abstract, their use has had a tangible effect on people's lives and the environment in general (Banerjee, 2016). Chemistry is frequently seen as the "central science" as understanding its ideas about the structure of matter is necessary to advance in the other sciences. Chemistry essentially serves as a gatekeeper for research in many other areas in the future (Dansu, 2022). Chemistry has also been recognized as a crucial science subject in the context of science education (Oladejo and Ebisin, 2021). Its significance in any country's scientific and technical advancements has been well documented (Onyewuchi, 2020). The

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concern expressed in policy reports, such as the Koech Commission Report of 1998, which stated that children should be introduced to scientific concepts from an early age, makes clear how important chemistry is to the curriculum (Tiimub, 2021).

Preparing students for the world of science and technology is one of the goals of Kenya's 8-4-4 educational system (Aziaka and Ikwut, 2018). Because of its many uses in daily life, chemistry is highly helpful in this regard. The use of chemistry has led to the growth of chemical industries, which produce a wide range of useful products for human use (Okebukola et al.,2020). The oil and steel, pharmaceutical, and petroleum sectors are a few typical examples of these industries. Chemistry specialists can be found working in medical labs, chemical businesses, and as chemistry teachers (West African Examinations Council (WAEC), 2020). In practical terms, everything we use has undergone a chemical process that has changed its native condition, which was of little or no value, to one of the very different appearances and far greater utility. Chemistry is the study of the transformation of natural resources (Adu-Gyamfi et al., 2020). Chemical processes produce many of the goods we use on a daily basis, including iron sheets, steel products, money, ceramics, cement, fertiliser, glass, pesticides, paints, detergents, and medications, to name a few. Any element that can strengthen Kenya's industrialisation efforts and, consequently, promote economic growth and sustainable development in line with Kenya Vision 2030 begins with chemistry education. According to Adewusi (2020), in order to achieve her vision 2030 and the Sustainable Development Goals (SDGs), the Kenyan government must look at chemistry education alongside other science topics.

According to Gongden et al., (2020), when science is taught and learned in laboratories, pupils are able to visualise topics and are more likely to comprehend and remember what they see than what they hear. Furthermore, Osei, (2018) contends that practical work and demonstrations have a strong persuasive force, enormous rhetorical strength, and enormous heuristic value. "If you don't see it, you won't believe it," he said. Furthermore, you won't comprehend it if you don't believe it. Additionally, you won't remember anything for very long if you don't comprehend it. The senses are crucial for both initial discovery and information acquisition. According to Famuwagun and Ojobola (2021), laboratory exercises are appealing because they allow students to learn with comprehension while also participating in the process of knowledge construction through scientific enquiry. Students' learning and comprehension of science are enhanced when they participate in scientific labs for practicals, claim Uzezi et al., (2017).

Chemistry is portrayed in the syllabus as a practical topic in the (8.4.4) Secondary School curriculum, where scientific concepts, principles, and abilities should be developed through experimental study. Chemistry is assessed at the national examination level, the Kenya Certificate of Secondary Education (K.C.S.E.), with one practical paper (233/3) and two theory papers (233/1 and 233/2). According to a 2007 report by the Kenya National Examination Council (KNEC), a candidate must have received a score of D+ (plus) or higher in the chemistry practical in order to receive a grade of B- (minus) or higher in the overall chemistry exam. The management of chemistry lab work in secondary schools is affected by this requirement. The chemistry practical exam assesses whether candidates have mastered the following competencies and skills, as listed by Oladejo et la., (2021): the ability to follow instructions to conduct experiments; manipulative skills, such as accurately measuring volume using a variety of measuring devices; the ability to accurately record observations; and the ability to draw conclusions.

These abilities align with some of the general goals of teaching and learning chemistry as outlined in the Kenya Institute of Education's (K.I.E.) 2002 Chemistry syllabus. The syllabus lists two practical goals that are emphasized: choosing and using the right equipment for experimental activity and making precise measurements, observations, and logical conclusions in experiments. KNEC gives the chemistry practical paper 40% of the final grade in order to highlight its significance. According to KNEC (2011) statistics, a student's overall Chemistry score is closely linked to their performance on the practical exam paper. KNEC (2011) states that a student must first receive at least 28 out of 40 points in the practical in order to receive at least an A (minus) mark. The following flaws in the Chemistry practical paper exams were noted in previous KNEC reports (2003, 2004) as contributing to candidates' poor performance in the subject.

1.1. Purpose of the study

To ascertain the connection between students' academic achievement in chemistry and the availability of laboratory supplies in Kilifi North Constituency, Kenya.

1.2. Research Hypotheses

Ha1: Students' academic achievement in chemistry is associated with the availability of laboratory supplies in Kilifi North Constituency, Kenya.

2. Literature Review

Omoniyi and Torru (2019) contend that learning resources are those tools, such as people and materials, used in the teaching and learning process to guarantee that the lesson's predefined, particular learning objectives are met. Since laboratory facilities are essential to effective science teaching and learning, Mkpaoro and Nwagu (2019) previously claimed that no significant science education programme could exist without them. Onowugbeda et al., (2022) made the following argument: Despite efforts to improve the quality of education, many African nations and developing nations in general frequently struggled to provide adequate circumstances and material resources, particularly laboratories and equipment. According to World Bank (2016), students' poor performance in chemistry during the 1970s and 1980s was caused by closed-ended laboratory investigations and inadequate equipment.

This was substantiated by Ralph and Lewis (2018), who found that inadequate science labs and equipment were the main reasons why secondary school students performed poorly in science classes. According to Kyado et al., (2021), 5% of Lagos State's post-primary schools lacked a laboratory and lacked adequate supplies. Students' performance in chemistry was found to be impacted by these factors. Their findings aligned with those of Eam et al., (2021), who elucidated that low academic performance in chemistry was a result of inadequate capital investment in the provision of science learning resources. In support, Tuitoek et al., (2015), Kiveu and WAEC, (2017), Kippra (2003), and others contended that since Kenya gained its independence, educational resources have been hard to come by. In his investigation on the relationship between the material environment of scientific labs and the learning outcomes of students in Nigeria, Lau and Lam (2017) discovered a favorable correlation between the academic performance of students and the environment of science labs.

According to a related study on the relationship between school amenities and academic accomplishment at secondary agricultural science schools in Ekiti State, Nigeria, conducted by Ernest et al., (2018), facilities have a significant impact on students' high academic achievement. One of the variables identified by Nartey and Hanson (2021) in his study on the factors influencing scientific accomplishment at the secondary level in Kenya was a lack of laboratory space and equipment. His results corroborate those of Kaltakci-Gurel et al., (2016), who identified a lack of a laboratory as one of the causes of subpar performance in the physical sciences in the Busia district of Kenya.

The success of any science course is heavily reliant on the laboratory facilities provided, and it may be argued that the laboratory is crucial to the teaching of sciences. This is corroborated by Oladejo et al., (2022), who found that scientific instructors generally agreed that laboratories play a key role in science education. This view was supported by Ademola et al., (2021) study on the affective management of Nigerian schools, which found that resource inequities resulted from the government's failure to develop policy directives on minimum criteria for school infrastructure. It may be argued that some schools possessed libraries, labs, and other facilities for efficient teaching and learning, while others had none at all or, if they did, they were ill-equipped, which resulted in subpar performance (Amusa et al., 2020).

According to Breakwell and Beardsell (2016), poor performance on scientific exams was a result of either insufficient or nonexistent laboratory space and/or facilities. In a related study that emphasized the value of learning resources in science instruction, Ango (1990) made the case that a teacher could only fulfil his goals if there were adequate resources accessible for both teaching and learning. Okebukola (2020) lamented the low performance of students in chemistry and reaffirmed that a lack of tools and resources for conducting practicals was one of the most frequently cited issues causing low performance in the field. In a same vein, Ramnarain and Ramaila (2018) stressed that the availability of appropriate resources, such laboratories, was essential for successful teaching and learning and improved students' performance on national exams.

It is impossible to overstate the value of educational resources in science instruction. In order to properly teach and learn the sciences, Naidoo and Sibanda (2020) emphasised the importance of material resources. According to Oladejo et al., (2021), the expectations for good science instruction brought about by technological advancement and the explosion of knowledge were the cause of the global changes in science curricula. One could argue that these modifications required the establishment of standardised resources at the educational institution where science education is based.

Lawal (2006) found no significant relationship between the quality of laboratory equipment and the academic performance of senior secondary school pupils studying chemistry, which runs counter to the aforementioned claim. Although it relied on how effectively it was utilized, the Secondary School Laboratory was undoubtedly a crucial part of learning science topics. According to Boachie et al., (2021), the sheer existence of a science lab does not ensure that students will perform well until there is effective utilization of the labs by both teachers and students. Ajai (2018), backed up this claim by stating that it would be difficult to determine the relationship between additional resources and results if they were inefficiently used. This straightforward finding made it clear that a direct examination into the connection between students' academic achievement in chemistry and the availability of laboratory supplies in schools was necessary.

3. Materials and Methods

The study used a correlational research method to examine the relationship between students' academic achievement in Chemistry, teacher qualifications, laboratory material availability, and laboratory use. According to Bizimana et al., (2021), the design entails gathering information to ascertain whether and how much a link exists between two or more measurable variables. Secondary schools in Kenya's Kilifi County's Kilifi North Constituency served as the study's sites. All public secondary schools in Kilifi County, all Form Four Chemistry teachers in public schools, and all Form Four students in public secondary schools made up the target population. The sample size consisted of eight secondary schools, or 47% of the total of 17 schools, which included one boys' school, one girls' school, and six mixed schools. Out of the 719 students in the population, 80 (or 11.13%) were Form Four students. Eight chemistry teachers were ultimately chosen from a total of 39 chemistry teachers in the sampled schools.

Using purposive sampling, only schools that have finished the Chemistry curriculum by the time of data collection were chosen. In schools with multiple Form 4 streams, just one stream was chosen to participate alongside their chemistry instructor using simple random sampling. Additionally, Form Four chemistry teachers were chosen by the use of purposeful sampling for the participating classrooms. Two sets of questionnaires were used: the Student's Questionnaire (SQ) and the Chemistry Teacher Questionnaire (CTQ). Information on laboratory material availability was gathered using an observation checklist. For the 2014 Kilifi District Mock Examination, students' performance on Chemistry Paper III (practical) at the conclusion of term two (July–August) was gathered from school records and entered into a Students' Score Sheet form. Two schools excluded from the main study participated in a pilot study that was carried out before the main study. Using the results of the pilot study, the validity and reliability of the instruments were enhanced. Utilizing the Statistical Package for Social Sciences (SPSS), data analysis was made easier.

4. Results

The study's primary goal was to ascertain the availability of permanent laboratory facilities, chemicals, equipment, and other laboratory supplies. According to Table 1, the majority of the study's schools (75%) possessed laboratories, and 25% of them had rooms that had been converted into labs as shown in table 1.

Table 1 Availability of Laboratory

Availability of Laboratory		Frequency	`Percentage
	Yes	6	75.0
	Modified rooms	2	25.0
	Total	8	100.0

n =8

Finding out how many laboratories there are in schools was another area of interest for the researcher. Table 2 displays the number of laboratories in schools. Of these, the majority (37.5%) had one shared laboratory for the three sciences of chemistry, biology, and physics, 25% had two laboratories, and 25% had modified rooms, while 12.5% had three laboratories, with one laboratory for each science.

Table 2 Number of Laboratories in School

Number of Laboratories		Frequency	Percentage
	1	3	37.5
	2	2	25.0
	3	1	12.5
	Modified room	2	25.0
	Total	8	100.0

n = 8

Determining whether chemistry equipment was available was another area of interest for the researcher. The researcher confirmed this by physical observation in table 3.

Table 3 Availability of Chemistry Apparatus

Apparatus	Availability of Chemistry Apparatus			Total	Mean
	SA	MA	HA		
Stands and clamps	3(37.5%)	4(50.0%)	1(12.5%)	8(100%)	2.75(68.75%)
50ml burettes	1(12.5%)	6(75.0%)	1(12.5%)	8(100%)	3.13(78.25%)
250ml volumetric	1(12.5%)	5(62.5%)	2(25.0%)	8(100%)	3.00(75.00%)
25ml pipettes	0(0%)	3(37.5%)	5(62.5%)	8(100%)	3.63(90.75%)
250ml conical flasks	0(0%)	6(75.0%)	2(25.0%)	8(100%)	3.25(81.25%)
100ml beakers	0(0%)	6(75.0%)	2(25.0%)	8(100%)	3.25(81.25%)
Boiling tubes	0(0%)	3(37.5%)	5(62.5%)	8(100%)	3.63(90.75%)
Tests tubes	0(0%)	2(25.0%)	6(75.0%)	8(100%)	3.75(93.75%)
Stop watches	0(0%)	4(50.0%)	4(50.0%)	8(100%)	3.50(87.5%)
Thermometer	0(0%)	3(37.5%)	5(62.5%)	8(100%)	3.63(90.75%)

Key; SA=Sparingly Available (2), MA= Moderately Available (3), HA= Highly Available (4)

The weighted mean of availability of stands and clamps was 2.75 (68.75%), with the majority of schools having moderately available (MA) stands and clamps (i.e., 50%), scarce available (SA) stands and clamps (37.5%), and highly available (HA) stands and clamps (12.5%). The majority of schools had moderately available (MA) or 75% of 50ml burettes, highly available (HA) at 12.5%, and sparsely available (SA) at 12.5%. The 50ml Burettes weighted average availability was 3.13, or 78.25 percent. Third, there were 62.5% fairly available, 25% extremely available, and 12.5% sparsely available 250 ml volumetric flasks. 250 ml volumetric flasks had a weighted mean availability of 3.00 (75%). The weighted mean availability of 25 ml pipettes was 3.63 (90.75%), with 62.5% being extremely accessible and 37.5% being moderately available. With a weighted average of 3.25 (81.25%), 250 ml conical flasks were fairly available in 75% of schools and extremely available in 25%. The weighted mean for 100ml beakers was 3.25 (81.25%), with 75% of them being moderately available and 25% being very available. The weighted mean availability of the boiling tubes was 3.63 (90.75%), with 62.5% being extremely available and 37.5% being moderately available. The weighted mean availability of the test tubes was 3.75 (93.75%), with 75% being extremely available and 25% being moderately available. With a weighted mean availability of 3.5 (87.5%), 50% of stopwatches were moderately available and 50% were extremely available. Lastly, the weighted average availability of thermometers was 3.63 (90.75%), with 62.5% being extremely available and 37.5% being moderately available.

The researcher also wanted to know if there were enough chemicals in the lab. The primary emphasis of the observation was the substances that are frequently utilized in laboratories. The researcher's observation and grading (table 4).

Table 4 Sufficiency of Chemicals in Laboratory

Chemicals	Sufficiency of Chemicals				Mean
	NA	IS	S	HS	
Sodium hydroxide	0(0%)	0(0%)	7(87.5%)	1(12.5%)	3.13(78.25%)
Sodium chloride	0(0%)	0(0%)	5(62.5%)	3(37.5%)	3.38(84.5%)
Barium nitrate	0(0%)	0(0%)	4(50.0%)	4(50.0%)	3.50(87.5%)
Sodium carbonate	0(0%)	0(0%)	3(37.5%)	5(62.5%)	3.63(90.75%)
Sodium hydrogen carbonate	0(0%)	2(25.0%)	2(25.0%)	4(50.0%)	3.25(81.25%)
Lead chloride	0(0%)	0(0%)	4(50.0%)	4(50.0%)	3.50(87.5%)
Zinc sulphate	0(0%)	0(0%)	5(62.5%)	3(37.5%)	3.38(84.5%)
Iron sulphate	0(0%)	3(37.5%)	2(25.0%)	3(37.5%)	3.00(75.00%)
Iron III sulphate	0(0%)	1(12.5%)	4(50.0%)	3(37.5%)	3.25(81.25%)
Sodium thiosulphate	1(12.5%)	0(0%)	5(62.5%)	2(25.0%)	3.00(75.00%)
Copper sulphate	0(0%)	0(0%)	6(75.0%)	2(25.0%)	3.25(81.25%)
Magnesium ribbon	0(0%)	0(0%)	2(25.0%)	6(75.0%)	3.75(93.75%)
Potassium permanganate	1(12.5%)	0(0%)	4(50%)	3(37.5%)	3.25(81.25%)
Hydrochloric acid	0(0%)	0(0%)	2(25.0%)	6(75.0%)	3.75(93.75%)
Sulphuric acid	0(0%)	0(0%)	3(37.5%)	5(62.5%)	3.63(90.75%)
Nitric acid	0(0%)	0(0%)	2(25.0%)	6(75.0%)	3.75(93.75%)

Key; NA=Not Available (1), IS=Insufficient (2), S=Sufficient (3), HS=Highly Sufficient (4)

The chemicals that are available in school laboratories are compiled in Table 9. Sodium hydroxide availability was found to be 87.5% sufficient and 12.5% very sufficient. Sodium hydroxide's weighted mean availability was 78.25 percent, or 3.13, which was adequate. The availability of sodium chloride was 62.5% sufficient, 37.5% very sufficient, and its weighted average availability was 3.38 (84.5%) sufficient. The weighted mean availability of barium nitrate was 3.5 (87.5%), which was both sufficient and extremely sufficient. The availability was 50% sufficient and 50% highly sufficient. The weighted mean availability for sodium carbonate was 3.63 (90.75%), which was highly sufficient, whereas the availability was 62.5% highly sufficient and 37.5% sufficient. The weighted mean availability of sodium hydrogen carbonate was 3.25 (81.25%), which was extremely available, with 50% of it being highly sufficient, 25% being sufficient, and 25% being insufficient. The weighted mean availability of lead chloride was 3.5 (87.5%), which was both sufficient and very sufficient. The availability was 50% extremely sufficient and 50% sufficient. The weighted mean availability for zinc sulphate was 3.38 (84.5%), which was sufficient, and the availability was 62.5% sufficient and 37.5% extremely sufficient. The weighted mean availability of iron sulphate was 3.00 (75%) which was both insufficient and highly sufficient. The availability of iron sulphate was 37.5% extremely sufficient, 37.5% insufficient, and 25% sufficient. Iron III sulphate had a weighted mean of 3.25 (81.25%), which was sufficient, and the availability was 50% sufficient, 37.5% extremely sufficient, and 12.5% insufficient.

The weighted mean availability for sodium thiosulphate was 3.00 (75%) which was sufficient, whereas the availability was 62.5% sufficient, 25% extremely sufficient, and 12.5% not available. The weighted average availability of copper sulphate was 3.25 (81.25%), which was sufficient, with 75% of it being sufficient and 25% being highly sufficient. The weighted mean availability for magnesium ribbon was 3.75 (93.75%), which was highly sufficient, while 75% was highly sufficient and 25% was sufficient. Potassium permanganate was accessible in the following percentages: 50% sufficient, 37.5% extremely sufficient, 12.5% not available, and 3.25 (81.25%) weighted mean availability. For hydrochloric acid, the weighted mean availability was 3.75 (93.75%), which was highly sufficient, while 75% was highly sufficient and 25% was sufficient. Finally, the weighted mean availability of sulfuric acid was 3.63 (90.75%), which was highly sufficient, and the availability of sulfuric acid was 62.5% highly sufficient and 37.5% sufficient. Lastly, the weighted mean availability of nitric acid was 3.75 (93.75%), which was extremely accessible, with 75% being highly sufficient and 25% being sufficient.

The researcher also wanted to know if there were any lab facilities that were thought to be essential for a working lab as shown in table 5.

Table 5 Availability of Laboratory Facilities

	Availability of Facilities	
Facilities	Available	Not Available
Fume cupboard	5(62.5%)	3(37.5%)
Weighing balance	8(100%)	0(0%)
Chemical and apparatus store	6(75%)	2(25%)
Bunsen burner	8(100%)	0(0%)
Piping system; tap water and sink	6(75%)	2(25%)

n = 8

According to Table 5, 62.5% of schools had fume cupboards, whereas 37.5% did not. Second, weighing balances and Bunsen burners were present in every school (100 percent). Only 25% of schools lacked a store for chemicals and equipment, whereas the majority (75%) possessed such stores. Similarly, 25% of schools lacked a sink and tap water supply, while 75% of schools had one.

The researcher also compared the suitability of the lab's working space to the suitability of the seating area, which was assessed using the teacher's perspective on the suitability of the stools (table 6).

Table 6 Cross tabulation of Adequacy of Laboratory Space and Laboratory Stools

Adequacy of Laboratory Space	**Adequacy of Laboratory Stools**			**Total**
	Disagree	Agree	Strongly Agree	
Strongly Disagree	1	0	0	1(12.5%)
Disagree	2	1	0	3(37.5%)
Agree	0	3	1	4(50%)
Total	3(37.5%)	4 (50%)	1(12.5%)	8(100%)

n = 8

Table 6 demonstrates that while the majority of participants (50%) felt that the laboratory space was acceptable, 12.5% strongly objected, and 37.5% disagreed. Additionally, the majority of participants (50%) felt that there was enough room for sitting, while 12.5% strongly agreed and 37.5% disagreed. Overall, half of the participants thought that the stools and lab workspace were sufficient.

"There is no relationship between the availability of laboratory materials and students' academic performance in Chemistry," according to one of the study's hypotheses. The Pearson Product Moment Correlation of Coefficient was used to evaluate the hypothesis. Table 7 illustrates the relationship between the average scores of students' academic performance on the chemistry mock practical test and the data on laboratory material availability gathered from each school's observation checklist.

Table 7 Correlation between Availability of Laboratory Materials and Students' Academic Performance

Paired Variable	**Correlation**	**Sig**
Availability of Laboratory Materials and School Mean Score in Chemistry Practical	0.819	0.013

n=8

The table's data demonstrates a significant linear association between laboratory material availability and chemistry practical performance, with a strong positive correlation ($r = 0.819$, $\alpha = 0.013$) at $\alpha = .05$. The r2 coefficient of determination of 0.6708 indicates that schools with well-equipped labs have comparatively high mean practical scores. Therefore, the availability of laboratory supplies accounts for 67.08% of performance in chemistry practicals, with other factors that were not taken into account in this study accounting for 32.92% of the remaining portion. Thus, the null hypothesis, H01, which states that there is no connection between students' academic achievement in chemistry and the availability of laboratory supplies, was rejected.

5. Discussion

In general, schools with sufficient laboratory supplies did better in chemistry practicals than those with insufficient supplies. The results of this study showed a correlation between students' academic achievement in chemistry and the availability of laboratory supplies. The research's conclusions aligned with those of earlier investigations. In his investigation on the relationship between the material environment of scientific labs and the learning outcomes of students in Nigeria, WAEC (2018), discovered a favorable correlation between the academic performance of students and the environment of science labs. Similarly, WAEC (2019), conducted a study on secondary school academic performance and school infrastructures. According to a study on agricultural science in Ekiti State, Nigeria, amenities have a significant impact on pupils' good academic accomplishment. Furthermore, one of the characteristics identified by Orodho (1996) in his study on the factors influencing scientific accomplishment at the secondary level in Kenya was a lack of laboratory space and equipment.

Additionally, in his research on the causes of subpar performance in the physical sciences in Kenya's Busia district, Kizito (1986) identified a lack of laboratory space as one of the contributing factors. The effectiveness of any science course greatly depends on the laboratory facilities provided, as the laboratory is crucial to the teaching of the sciences. Ogunniyi (1993), who stated that there is broad agreement among scientific educators that laboratories play a crucial role in science education, lends support to this. Furthermore, the government's reluctance to develop policy directives on basic criteria in respect to school facilities has allowed for inequities in acquisition, according to Asiabaka's (2008) study on the emotional management of schools in Nigeria. This is due to the fact that although some have libraries, labs, and other facilities that are well-equipped for efficient teaching and learning, others do not, and those that do have inadequate equipment, which results in subpar performance.

6. Conclusion

It is evident from this study that the availability of laboratory supplies, laboratory usage, and the academic credentials of the teacher all contributed to the students' academic success in chemistry. Therefore, inadequate laboratory use may be the primary cause of subpar chemistry performance. The findings of the Pearson Product Moment Correlation test showed a high positive correlation at 0.05 significance between the availability of laboratory materials. Similarly, the findings of the Pearson Product Moment Correlation test on laboratory use and students' chemistry performance indicate a moderately significant link at 0.05 significance. Lastly, the findings of the Spearman's Rank Order Correlation test showed a significant positive link at 0.05 significance between the academic background of the teacher and the chemical performance of the students. The findings supported the general literature, which states that students' academic success in chemistry is positively correlated with the availability of laboratory supplies, laboratory usage, and the academic background of the teacher.

Recommendation

To increase students' academic performance in chemistry, schools should priorities the improvement and upkeep of laboratory facilities, ensuring that the necessary equipment and chemicals are regularly available. Laboratory resources should be assessed on a regular basis to detect and resolve any shortfalls. Furthermore, professional development for teachers on successful laboratory methods could help them make the greatest use of existing resources while also encouraging schools to collaborate to exchange best practices and materials. Investing in these areas will improve the learning environment and, eventually, student results in chemistry.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict-of-interest to be disclosed.

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