SCHOOL ADMINISTRATORS PERCEPTIONS ON THE EFFECTS OF LEVEL OF AVAILABILITY OF LABORATORY RESOURCES ON THE SERVICE DELIVERY OF STEM TEACHERS

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Abstract

The study investigated school administrators' perceptions on the effects of level of availability of laboratory resources on the service delivery of STEM teachers. Two research questions were raised and two hypotheses formulated to guide the study. The survey research design was adopted for the study. The population of the study comprised all principals of the 46 public secondary schools and 72 private secondary schools in Calabar education zone of |Cross River state. This gave a total of 118 principals. The 118 principals also formed the sample of the study as this number is manageable. The instrument used for data collection is titled: level of availability of laboratory resources and service delivery of STEM teachers questionnaire(ALRSDSTQ) The reliability outcome of 0.88 yielded from the Cronbach Alpha test. Data collected was analyzed using mean ratings and t-test statistics for the research questions and hypothesis respectively. Results from the analysis revealed the various ways the level of availability of library resources can affect STEM teachers service delivery and hindrances to STEM teachers' utilization of laboratory resources. Results also revealed that there is no significant difference between the perception of school administrators on the effects of level of availability of laboratory resources on STEM teachers service delivery. Further results revealed that there is no significant difference in the perception of school administrators on hindrances to STEM teachers' utilization of laboratory resources. Based on the findings, it was recommended among others that government and proprietors should endeavor to provide the needed and necessary laboratory resources in secondary schools so that teachers can effectively deliver their services.

Introduction

In order to meet the needs of a dynamic job market centered on innovation, technology and creativity, countries are beginning to lay emphasis on the integration of elements of science, technology, engineering and mathematics (STEM) into the school curriculum. Schools at all

levels especially in developed countries are already in this process while schools in the third world countries are striving to catch up with this inevitable trend.

By integrating stem activities across learning areas, any year group and children are given opportunities to develop the qualifications and skills needed to constantly adapt in a dynamic and evolving employment landscape (Department of Education, Government of Australia, 2023). It is widely known that the continual advances in technology is speedily dismantling the traditional ways of carrying out organizational processes and operations. To keep pace with the demands of modern industry, appeals for educational institutions to integrate sciences in their curriculum is mounting globally thus calling for seriousness in the acquisition of STEM knowledge and skills by all students. Researchers (Mark 2021, Truman 2022, Shiri 2022, Uko and Nnaji 2015, Uko, Adie 2019 and Nnaji 2016) agreed that students develop relevant transferable skills through STEM curriculum. Some of the skills that could be acquired through STEM are in the areas of creativity, innovativeness, problem solving, digital literacy, communication, critical analysis and independent thinking.

However, central to the implementation of STEM integrated curriculum and students acquisition of the laudable STEM skills is the teacher and their service delivery. The teacher is the heart and soul of the educational programme (Nnaji et al,2023). Service delivery of teachers is the ability of teachers to successfully render those essential activities and services that are required in the attainment of educational goals and objectives. These services are rendered at the different levels of the school system with students as the sole beneficiaries. Deni (2021) outlined these essential services to include; academic advising, guidance and consulting, safety services, academic relation with students, social support services, instructional delivery, students record management, students' evaluation and classroom management. In practice, secondary schools usually employ trained teachers who utilize a combination of other educational resources to achieve success in their jobs (Okri et al 2018;, Difo. 2021).

Rotimi (2021), noted that in the context of STEM education in secondary schools, the laboratory is a crucial necessity. A laboratory is a building or room equipped for scientific work. Merrian-webster in George (2015) defined the laboratory as a room or building with special equipment for doing scientific experiments and tests. Laboratories are usually built in schools for use in teaching, experimentation, practice and learning of sciences and other related subjects. The teaching and learning process in sciences involves series of activities and the expert knowledge and skills of the teacher is needed in the coordination of these activities. Sani (2023) emphasized that student's ability to master science process skills depends on the extent of commitment of teachers to service delivery both in the laboratory and the classroom. Titu (2011) noted that for effective teaching and learning of subjects such as biology, chemistry, physics, mathematics, integrated, introductory technology and other science related subjects there is need for well-equipped laboratories in schools. According to (Nnaji et al 2015), the science laboratory should be carefully planned, designed and adequately equipped with other necessary laboratory resources such as chemicals, reagents, gloves, specimens, models chairs, microscopes, desks and other resources according to the requirements of the subject it is built for.

Umeh (2006) remarked that items of school laboratory are essential aids to effective teaching and where learning facilities are available and effectively utilized, seemingly complex processes of teaching and learning can be made simple and students in such environment may show more evidence of effective learning than their counterparts in schools where these materials and facilities are not used. Amos (2010) concluded in a study that there is a significant relationship between availability of laboratory equipment and students' achievement in science subjects. With the availability of a well-equipped laboratory in schools, learning experiences would be presented in a concrete form such that students can easily observe, manipulate, explain and analyze concepts (Amidi 2012). David (2011) asserted that teachers who are provided with laboratory equipment would be more effective in explaining concepts, demonstrating concepts and arousing the zeal for learning of sciences in students. Amos (2010) however lamented that

the non-existence of laboratory facilities and technical workshops in schools in Nigeria has undoubtly become the bane of effective teaching and learning of science and technology in secondary schools. According to him, trying so hard to teach students certain practical phenomenon without the necessary equipment can be so frustrating and discouraging. Research carried out by Edoki (2013), Udeme (2014) and Adams (2018) indicated very low availability of laboratory facilities in public schools in Enugu State. A survey of public secondary schools by Udeme's (2014) spotlights lack of adequate laboratory equipment in schools surveyed. Rimanna (2022) found that public and private school principals in Lagos State both agreed that both public and private schools are facing the challenges of inadequate school facilities. Teachers are usually restrained and limited in their service delivery by lack of facilities and unconducive learning environment (Emezife, 2021)

In their studies, Abah (2011), Dohni (2022) and Bolton (2022) found out that students of both private and public schools agreed that availability of science equipment will help their teachers in several areas. According to Abah (2011), the provision of science and technology facilities in schools will not only enhance students' zeal for STEM but also enhance teachers' efforts. Abah (2011) stated that science equipment usually helps teachers in the grooming of students to have the abilities to perform science related operations such as making accurate measurements, readings and titrations with reasonable accuracy. Unfortunately, students of secondary schools in Calabar education zone have evidently shown seemingly lack of zeal in STEM subjects judging from their poor performance in science subjects and the relatively few number of students offering science subjects in the secondary schools. Nweke (2022) considered poor service delivery of teachers as the cause of students' poor performance in science subjects. Adams (2011) argued that lack of teachers' commitment to service delivery in schools is mainly due to lack of facilities which makes students failure inevitable. Nweke (2022) noted that lack of teacher effectiveness in schools is not hinged on remuneration but primarily because of lack of teaching facilities and general inadequacy of school infrastructure. Nwankwo (2022) however, stated that teachers of both private and public schools are optimistic that facilities and other infrastructural materials will be provided in their schools so that their performance rate will be not questionable.

Statement of the Problem

The cardinal task of teachers is to inculcate worthwhile knowledge and skills in the learner. In the present age of digitalization and massive dependence on science and technology, science teachers are expected to inculcate in the schools' technical skills, knowledge of the sciences and the zealousness for STEM subjects. However, the poor performance of students in STEM subjects (Biology, chemistry, physics and mathematics) in both external and internal examinations calls into question the service delivery of teachers. Students are rarely taken to science laboratories for practical and further experimental experiences by their teachers. This situation has raised a lot of worry in the minds of stakeholders in education as to whether there is adequate science and technology laboratory equipment for the effective teaching and learning of STEM subjects in schools. In the light of this, this study is poised to ascertain the effects of level of availability of laboratory resources on the service delivery of STEM teachers as perceived by school administrators.

Research questions

The following research questions guided the study:

1. What is the perception of public and private school administrators on the effects of level of availability of laboratory resources on service delivery of STEM teachers?
2. What is the perception of public and private school administrators on the hindrances to STEM teachers' utilization of laboratory resources for instructional service delivery in secondary schools?

Hypothesis

The following hypotheses were formulated to guide the study.

1. There is no significant difference between the perception of public and private school administrators on the effects of level of availability of laboratory resources on the service delivery of STEM teachers.
2. There is no significant difference between the perception of public and private secondary school administrators on the hindrances to STEM teachers' utilization of laboratory resources for instructional delivery.

Methodology

The study adopted a survey research design. The population of the study comprised all 46 principals in the public secondary schools and 72 private secondary schools in Calabar education Zone. This gave a total of 118 subjects. The 118 principals were all used for the study as there was no sampling technique because the population was small and manageable. The instrument used for the data collection was a researcher constructed questionnaire titled: "Effects of level of availability of laboratory resources on the service delivery of STEM teachers questionnaire" (ELALRSDSTQ). The instrument is divided into two sections; A and B. Section A contains 8 items that elicited perception of principals on the effects of level of availability of laboratory resources on service delivery of STEM teachers and 7 items on the perception of principals on the hindrances to STEM teachers' utilization of laboratory resources. Section B was a modified 4 point Likert type built on a scale of strongly Agree (SA) – 4 points, Agree (A) – 3 points, Disagree (D) – 2 and strongly Disagree (SD) – 1 point. The instrument was validated by two experts in Educational measurement and evaluation, faculty of Educational Foundation, University of Calabar. The reliability of the instrument was established using Cronbach Alpha Analysis. The reliability coefficient value yielded 0.83 which was considered adequate for the study. A total of 118 copies of the questionnaire were distributed personally by the researchers to the respondents. The researchers chose one week for this distribution so as to have ample time to cover all the schools used for the study. The researchers gave the respondents two days to fill the questionnaires and revisited the schools to retrieve them. All 118 questionnaire distributed were returned. The data collected was analyzed using mean ratings and t-test statistics for the research question and hypothesis respectively. The decision rule for the mean was set at 2.50. Therefore, any mean score that is equal to or higher than 2.50 represent positives response while any mean score that is lower than 2.50 response negative response.

Results and Discussion

Research question one

What is the perception of public and private school administrators on the effects of level of availability of laboratory resources on service delivery of STEM teachers?

Table 1: Mean ratings on the perception of public and private school administrators on the effects of availability of laboratory resources on (STEM teachers) service delivery in secondary schools.

S/N	Item	X	SD	Decision	X	SD	Decision
1	Aids teachers in the explanation of science concepts to students.	3.86	0.54	Agreed	3.80	0.45	Agreed
2	Aids teachers in the explanation of different types of laboratory equipment and their uses to students	3.77	0.42	Agreed	3.62	0.40	Agreed
3	Aids teachers in guiding of students on the best safety measures in the laboratory.	3.84	0.41	Agreed	3.51	0.38	Agreed
4	Aids teachers in the explanation of characteristics of reagents	3.92	0.32	Agreed	3.55	0.32	Agreed
5	Aids teachers in the demonstration to students the right combination or mixture of chemicals for experiments.	3.71	0.40	Agreed	3.66	0.35	Agreed
6	Equips teachers with the tools for brining abstract science concept to reality for the study	3.80	0.82	Agreed	3.78	0.37	Agreed
7	Equips, teachers with tools for bringing abstract science concepts to reality inequality science process skill in the studies	3.77	0.42	Agreed	3.54	0.46	Agreed
8	Serves as sources of motivation to STEM teachers	3.66	0.43	Agreed	3.53	0.33	Agreed

Table 1 revealed that the 8 items obtained high mean scores for public and private school administrators which are all above the decision rule. This implies that both public and private secondary school administrators agreed that the effects of availability of laboratory resources will have on STEM teachers are that; it aids teachers in the explanation of science concepts to students, aids teachers in the explanation of different types of laboratory equipment and their uses to students, aids teachers in the guiding of students on the best safety measures in the laboratory, aids teachers in the explanation of the characteristics of reagents and other chemicals to students, aids teachers in the demonstration of the right mixture of chemicals for experiments, equips teachers with the tools for bringing abstract science concept to reality, equips teachers with tools for inculcating science process skills in the students and serves as a source of motivation to STEM teachers.

Research question 2

What is the perception of public and private school administrators on the hindrances to STEM teachers' utilization of laboratory resources for instructional service delivery in secondary schools?

Table 2:
Mean ratings on the perception of public and private school administrators on the hindrances to STEM teachers' utilization of laboratory resources for instructional service delivery in secondary schools?

S/N	Item	Public school administration			Private school administration		
		X	SD	Decision	X	SD	Decision
9	Unavailability of science laboratory	3.44	0.39	Agreed	3.41	0.33	Agreed
10	Inadequacy of laboratory resources	3.50	0.37	Agreed	3.38	0.30	Agreed
11	Outdated laboratory resources	3.42	0.35	Agreed	3.53	0.45	Agreed
12	Poor electricity supply	3.02	0.32	Agreed	3.49	0.32	Agreed
13	Faulty laboratory equipment	3.52	0.43	Agreed	3.43	0.39	Agreed
14	Unconducive laboratory environment	3.45	0.30	Agreed	3.57	0.50	Agreed
15	Poor remuneration of STEM teachers	2.28	0.41	Disagreed	2.25	0.38	Disagreed

Table 2 revealed that items 9,10,11,12, 13 and14 obtained high mean scores above the decision rule of 2.50 for public and private school administrators. This implies that both public and private school administrators agreed that unavailability of science laboratory, inadequacy of laboratory resources, outdated laboratory equipment, poor electricity supply, faulty laboratory equipment and unconducive laboratory environment are hindrances to STEM teachers' utilization of laboratory resources for instructional delivery in secondary schools. Low mean score below the decision rule was however obtained for item 15 which imply that public and private school administrators disagreed that poor remuneration of teachers hinders STEM teachers' utilization of laboratory resources for instructional delivery in secondary schools.

Hypothesis 1:
There is no significant difference between the perception of public and private school administrators on the effects of availability of laboratory resources on the service delivery of STEM teachers.

Table 3:
t-test analysis of the perception of public and private secondary school administrators on the effects of availability of laboratory resources on the service delivery of STEM teachers.

Respondents	N	X	Sd	Df	t-cal	t-critical	Prob.	Decision
Public school administrators	46	3.3.1	0.42					
				116	1.42	2.05	0.5	H_0 accepted
Private schools administrators	72	3.42	0.49					

The analysis in table 1 above shows that the calculated t-value of 1.42 is less than the t-critical value of 2.05. The null hypothesis is therefore accepted. This means that there is no significant difference between the perception of public and private secondary school administrators on the effects of availability of laboratory resources on the service delivery of STEM teachers.

Hypothesis 2

There is no significant difference between the perception of public and private secondary school administrators on the hindrances to STEM teachers' utilization of laboratory r3eosurces for instructional delivery.

Table 4: t-test analysis of the perception of public and private secondary school administrators on the hindrances to STEM teachers' utilization of laboratory resources for service delivery.

Respondents	N	X	Sd	Df	t-cal	t-critical	Prob.	Decision
Public school administrators	46	3.06	0.40					
				116	1.11	2.05	0.5	H_0 accepted
Private schools administrators	72	3.23	0.39					

Table 4 shows that t-calculated of 1.11 is less than t-critical of 2.05. The null hypothesis is therefore accepted. This means that there is no significant difference between the perception of public and private secondary school administrators on the hindrances to STEM teachers' utilization of laboratory resources for s4rvice delivery.

Discussion of findings

The results of the research in table 1 revealed that both public and private school principals agreed that the effects that availability of laboratory resources could have on STEM teachers are that, it aids teachers in the explanation science concepts to students, aids teachers in the explanation of different types of laboratory equipment and their uses to students, aids teachers in the guiding of students on the best safety measures in the laboratory, aids teachers in the explanation of the characteristics of chemicals and reagents, aids teachers in the demonstration of the right mixture of chemicals for experiences, equips teachers with the tools for bringing abstract science concepts to reality for the students, and serves as source of motivation for STEM teachers. This result was confirmed in table 1 by the high mean scores obtained by items 1,2,3,4,5,6,7,8,9,10,11,12,13 and 14. This result is in agreement with Umeh (2006) who remarked that items of school laboratory are essential aids to effective teaching and learning and should not only be available but be of good quality. Availability of laboratory resources in secondary schools is very vital because of the various roles they play in helping STEM teachers achieve their service delivery objectives.

This result also agrees with Abah (2011) who highlighted the effects of availability of laboratory resources on STEM teachers service delivery by stating that science equipment usually help teachers to groom students to have the ability to perform science related operations with reasonable accuracy. This shows the indispensability of laboratory resources to STEM teachers in rendering their services to students. This results also corroborates the assertion by David (2011), that teachers who are provided with laboratory equipment would be more effective in explaining concepts, demonstrating concepts and arousing the zeal for learning science in the students. Availability of laboratory resources is sure to yield positive effects on STEM teachers by serving as a morale booster and motivating factor for STEM teachers job commitment.

Finding of table 2 revealed that public and private secondary school administrators agree that unavailability of science laboratory, inadequacy of laboratory resources, outdated laboratory equipment, poor electricity supply, faulty laboratory equipment and unconducive laboratory environment are the hindrances to STEM teachers' utilization of laboratory resources for instructional service delivery in secondary schools. This finding aligns with Emezife (2021) who submitted that teachers are usually restrained and limited in their service delivery by lack of facilities and unconducive learning environment. This implies that STEM teachers who are committed to their jobs may be restrained from giving their best to the students because of total lack of science laboratory, inadequacy of laboratory, outdated laboratory equipment, poor electricity supply and faulty laboratory equipment. This finding is also in tandem with Amos (2010) who lamented that the non-existence of laboratory facilities and technical workshops in schools in Nigeria has undoubtedly become the bane of effective teaching and learning of sciences in secondary schools. Amos (2010) further stated that trying so hard to teach students certain practical phenomenon without necessary equipment can be so frustrating and discouraging. This situation can cause disenchantment in the teachers thus drastically reducing their productivity. The result of table 2 also revealed that school administrators disagreed the poor remuneration is a hindrance to the utilization of laboratory resources by STEM teachers for instructional service delivery. This finding is in consonance with Nweke (2022) who noted that lack of teacher effectiveness in schools is not hinged on remuneration but primarily because of lack of teaching facilities and general inadequacy of school infrastructure. This is an indication that a poorly remunerated STEM teacher who is provided with the necessary laboratory resources would perform his/her job effectively.

Findings from table 3 and 4 revealed that the two hypothesis were accepted indicating that there is no significant different in the mean ratings of responses from public and private school administrators on the effects of availability of laboratory resources on service delivery of STEM teachers and the hindrances to utilization of laboratory resources by STEM teachers. This finding was supported by Rimanna (2022) whose finding indicated that public and private school principals in Lagos State both agreed that both public and private schools are facing the challenges of inadequate school facilities. The reason for the similar outcome of the two hypothesis could be because principals are the ones who carry out internal supervision in schools and are therefore better positioned to understand the effects that availability of laboratory resources could have on service delivery of teachers. They also understand the possible factors that can hinder STEM teachers from utilizing laboratory resources for instructional service delivery.

Conclusion

This study has highlighted the effects of level of availability of laboratory resources on service delivery of STEM teachers and the hindrances to the utilization of laboratory resources by STEM teachers. It has also been established that both public and private secondary school administrators did not differ in their perception on the effects of level of availability of laboratories on service delivery of STEM teachers as well as the hindrances to utilization of laboratory resources by STEM teachers. It is therefore concluded that availability of laboratory resources in secondary schools will have positive effects on service delivery of STEM teachers while unavailability of these resources will pose a hindrance to the effectiveness of STEM teachers instructional service delivery even when their remuneration is satisfactory.

Recommendations

1. Government and private school owners should endeavor to provide all the needed laboratory resources in public and private schools to enable STEM teachers' performance their jobs effectively and professionally.

2. Adequate funds should be made available to both public and private secondary schools principals as imprest to replace outdated or warn out equipment in their science laboratories.
3. Secondary school principals should draw up facilities maintenance plan to ensure periodic maintenance of laboratory resources in their schools.
4. The inspectorate division of the ministry of education should carry out regular monitoring and inspection in secondary schools to accredit schools with standard functional laboratories and sanction those without standard functional science laboratories.

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