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Original Article

### School-Based Variables' Influence on Performance in the Kenya Certificate of Secondary Education in Sub-County Schools in Kakamega County, Kenya

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#### Keywords:

*School Infrastructure,  
Science Laboratories,  
ICT facilities,  
Libraries,  
KCSE Performance.*

This study was conducted to examine the potential influence that school infrastructure has on KCSE performance in Kakamega Central Sub-County, in Kakamega County, Kenya. The objective of the study was to establish the influence of libraries, science and computer laboratories on KCSE performance in Kakamega Central Sub-County category of schools. The education production function theory, which links school variables such as infrastructure to student achievement, guided the study. The study employed the descriptive research design and was conducted in Kakamega County in Kenya. The target population was 25 school principals, 300 teachers and 2319 students. Purposive sampling was used to sample the principals, while simple random sampling was used to sample the teachers and students. The sample size included 11 school principals, 90 teachers and 464 students, totalling 565 individuals. Data was collected using questionnaires, interviews and observation checklists. Data triangulation and expert judgment were used to guarantee the content validity of research instruments. Piloting was done in 2 schools with poor performance in KCSE in the last 5 years to refine the questionnaires used in the study. Quantitative data was analysed using descriptive and inferential statistics and the Statistical Package for Social Sciences (SPSS version 20). Data was presented in pie charts, bar graphs and frequency distribution tables. Qualitative data was put into similar themes and presented through narration and verbatim. The study revealed that schools in the region experienced constraints with physical facilities. Some schools did not have libraries, science and computer laboratories, among other facilities. Others encountered inadequate stocking of the laboratories and library facilities, which limited students' options for reference materials, lab equipment and reagents. The study concluded that the inadequate and, in some cases, lack of physical infrastructure negatively influenced KCSE performance in the sub-county. The study recommends that the schools in the region should engage in a resource-sharing network between schools that have facilities and those that lack them, and set up a donation drive, inviting the community and other non-governmental organisations to donate these resources to supplement the government funding that they receive.

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## INTRODUCTION

Science laboratories, computer laboratories and libraries are some of the infrastructure essential for schools. Akungu (2014) notes that students' performance in national examinations is reliant on school facilities, which determine the quality of instructional methods. Kalagbor (2016) further asserts that the presence and proper utilisation of physical facilities in a school enhances curriculum delivery and boosts the quality of education, leading to better results in national examinations.

The science laboratory, as stipulated by the instructional theory of learning, directly affects students' approaches and academic achievement in science subjects. Practical lessons are known to lead to a better understanding of what is taught in the classroom. According to Pareek (2019), laboratories allow students to be creative and innovative. Pareek (2019) further argues that practical science lessons enable students to understand and recall concepts. In the general sense, laboratories are integral to the instruction of science and other science-related subjects as they reinforce the understanding of concepts, leading to better academic outcomes. Students also learn better by engaging in practical work, and regular exposure to practical lessons

promotes the performance of students in national examinations (Mulinge 2017).

Libraries are impactful on students' performance because they are centres for information and knowledge where students study and come up with new innovations. Kalagbor (2016) asserts that the library is a very significant facility in the school as it directly aids the teaching and learning process. Okoroma and Orike (2019) report that libraries enable students to think critically as they are exposed to textbooks, newspapers and magazines. Libraries promote the acquisition and invention of new knowledge and ideas, which not only promote academic achievement but also contribute to lifelong problem-solving. Well-stocked libraries lead to better performance, whereas schools that lack libraries or are insufficiently stocked may post poor grades in internal and external examinations, as learners are limited to the classroom knowledge (Okoroma and Orike, 2019).

In Malaysia, the use of ICT facilities in learning has a major influence on performance in national examinations. Ghavifekr and Rosdy (2015) note that ICT integration is now an integral aspect of learning in Malaysian schools since it enables students to enrich their collaborative learning skills.

Through ICT, learners develop transferable skills that motivate social skills, problem-solving and independence. The gradual improvement in performance of students in national examinations in Malaysian schools is partly attributed to the upscaling of schools with ICT facilities such as smart boards, computer laboratories and internet connectivity. Ghavifekr and Rosdy (2015) also report that the incorporation of ICT leads to great successes for Malaysian teachers and students, with students posting better grades in national examinations as a result of technology-based teaching and learning.

In Rwanda, studies reveal the significance of school facilities on students' achievement. In their study, Uwimana and Andala (2020) note that classrooms, libraries and laboratories, adequate play areas and school sanitation positively influence academic performance in national examinations. The study, however, revealed that even though these facilities were important, their provision was inadequate, leading to poor performance in national examinations among year 12 learners (Uwimana and Andala 2020).

In Kenya, studies show that school variables have an influence on KCSE performance across the country. Ireri, Mukirae and Otieno (2022) acknowledge that in Kenya, school facilities positively influence learners' performance in national examinations. Findings from their study in Muranga County revealed that schools had inadequate infrastructural facilities, which contributed to the poor performance of students (Ireri et al., 2022).

Notably, in Kakamega County, the number of students sitting for KCSE has increased in the last five years and although the number of quality grades is gradually increasing, there is also an alarming rise in students with poor grades, with many of the sub-county schools posting a low mean grade of 3 or below. Studies done in the county indicate that various factors could be affecting performance. Anekeya (2015) found that inadequate facilities

impact the quality of education in primary schools in the county, leading to poor performance.

### **Statement of the Problem**

KCSE results in Kakamega Central Sub-County schools show that most schools fail to attain the average mean scores. The expectations of the Ministry of Education is a minimum C+ for degree courses, C plain for diploma courses and C- and D+ for certificate courses, yet, the majority of students from sub-county schools attain an average mean of D. This is despite government interventions like employing more teachers, equipping schools with free textbooks and subsidising secondary education. These efforts are expected to ensure efficiency in learning and promote better performance in the KCSE, yet in Kakamega Central sub-county, students still perform poorly.

This study investigated how teacher-student ratios, school facilities and teaching and learning materials influence KCSE performance in sub-county schools in Kakamega Central Sub-County.

### **LITERATURE REVIEW**

Physical resources, which are facilities needed for a curriculum to be implemented. The resources entail facilities that serve as places of teaching and learning and are known to impact education outcomes significantly. Cuesta et al. (2016) identify school size, location, capacity, condition of buildings and their utilities, services and equipment as attributes of a school's physical environment. They further posit that in third-world countries, the provision of electricity, libraries and laboratories improves learning and facilitates better education outcomes (Cuesta et al., 2016). Furthermore, the availability of clean water, spacious and clean classrooms, toilets and functional furniture in schools leads to better educational outcomes.

In Latin America, several studies have shown that better infrastructure improves academic achievement. According to Cuesta, Glewwe, & Krause (2016), facilities such as toilets, bigger

classes, clean water, laboratories and libraries improved learning in Latin America. In Texas, USA, Bullard (2011) studied the impact of school facilities on the learning environment in high schools in the Northeast region. From the study, Bullard (2011) concluded that the presence and quality of learning facilities significantly correlated with the achievement of students.

A study by Kalagbor (2016) that analysed factors influencing academic performance in private and public schools in Nigeria found that inadequate laboratories and libraries negatively influenced the academic achievement of students in public schools and private schools. A different study in Rwanda agrees that inadequate infrastructure reduced the academic performance of year 12 learners. This study found the association between school infrastructure and performance to be slightly positive. This correlation was attributed to inadequate libraries, crowded classrooms and students' inability to use libraries and laboratories due to insufficient equipment (Uwimana & Andala, 2020).

In Kenya, Ileri, Mukirae and Otieno (2022) also observe that school facilities positively influence learners' performance in national examinations. The study done in selected national schools to assess the influence of school facilities on KCSE also revealed that the schools had inadequate infrastructural facilities. Classrooms were congested, libraries were found to be insufficiently equipped and laboratories were inadequate. Crowded classrooms, inadequate libraries and laboratories were found to be major contributors to poor KCSE performance in the counties of Isiolo, Marsabit and Samburu (Ileri et al., 2022).

## METHODOLOGY

The research design used in the study was descriptive, where the researcher aimed to find out the nature of a certain phenomenon. Mugenda & Mugenda (2019) state that this design is suitable in order to collect data to provide answers to questions

related to the current state of the subjects of the investigation. This research design was useful in identifying patterns in KCSE performance in Kakamega Central Sub-County's schools. The school factors studied included their influence on the KCSE performance of the sub-county. This type of design was found suitable as it helped the researcher to report about the phenomenon of low school performance within the area.

The overall population size of the study was 2640. It consisted of 21 school principals, 300 teachers and 2,319 Form 3 students in 21 sub-county secondary schools. The sample studied was 565 respondents comprising 11 principals, 90 teachers and 464 students.

The sample size was determined using different techniques. In the case of schools, there was a systematic selection of the 11 schools out of the 21 schools in the sub-county. That was done by enumerating all the schools and picking every alternate school, which gave an estimated sampling interval (K) of 2 and sampled about 52 percent of the schools. Purposive sampling was used on the 11 principals because they had years of experience in teaching and were running schools. Teachers and students were selected using simple random sampling. The researcher took 90 teachers, who were 30 percent of the 300-teacher population. The number of students sampled was 464 and this represented 20 percent of the total number of students (2319). In case of a smaller population, 30 or greater percent of the population can be considered to be a good sample.

Questionnaires, interviews and checklists of observations were utilised as primary databases. The data was collected about the variables like teacher-student ratios, physical facilities, and teaching materials by use of questionnaires by students and teachers. Data relevant to similar variables were measured using an interview, which was performed among principals and provided more insight due to the presence of both verbal and nonverbal cues. In the real-time data recording of

the availability of classes, laboratories, and other physical facilities observation checklist were utilised.

In an attempt to analyse data, the study applied both qualitative and quantitative data analysis. The coding of quantitative data was conducted and inserted into SPSS version 22 to analyse, and descriptive statistics such as percentages and frequencies were utilised. All the results were displayed in the form of frequency tables of distribution, bar graphs and pie charts. Qualitative data was presented using narration and verbatim quotations.

The pilot study was done among two sub-county schools in Kakamega East Sub-County to measure the sustainability of the research tools and their clarity. The pilot study results were employed to make improvements on the questionnaires. In an attempt to find a sense of validity in the instruments, the researcher consulted supervisors and other researchers on matters relating to the content validity. Reliability was assessed using the test-retest method and Cronbach's alpha test, with a cutoff point of 0.7.

It was also ethical because it sought the approval of the research by Kenyatta University and NACOSTI to undertake the study. The principals of the 11 schools and all of the respondents provided informed consent. The anticipated study and expected nature of the research were described to the subjects, and they were assured that the privacy of the information would be kept.

## RESULTS AND DISCUSSIONS

The objective of this study was to assess the influence of physical resources on KCSE performance (Science Laboratories, ICT and computer libraries).

In the observation checklist, the researcher observed that some schools had science laboratories, ICT laboratories and a library, while other schools lacked these facilities. In some schools, the class size were enough while others seemed congested. According to Figure 1 below 55% of the principals indicated they had constraints with physical facilities in their school, while 45% did not experience any constraints with physical facilities. In an interview, one of the respondents stated:

*The home science lab is missing, we don't have a computer lab, and there is no adequate land for farming projects.*

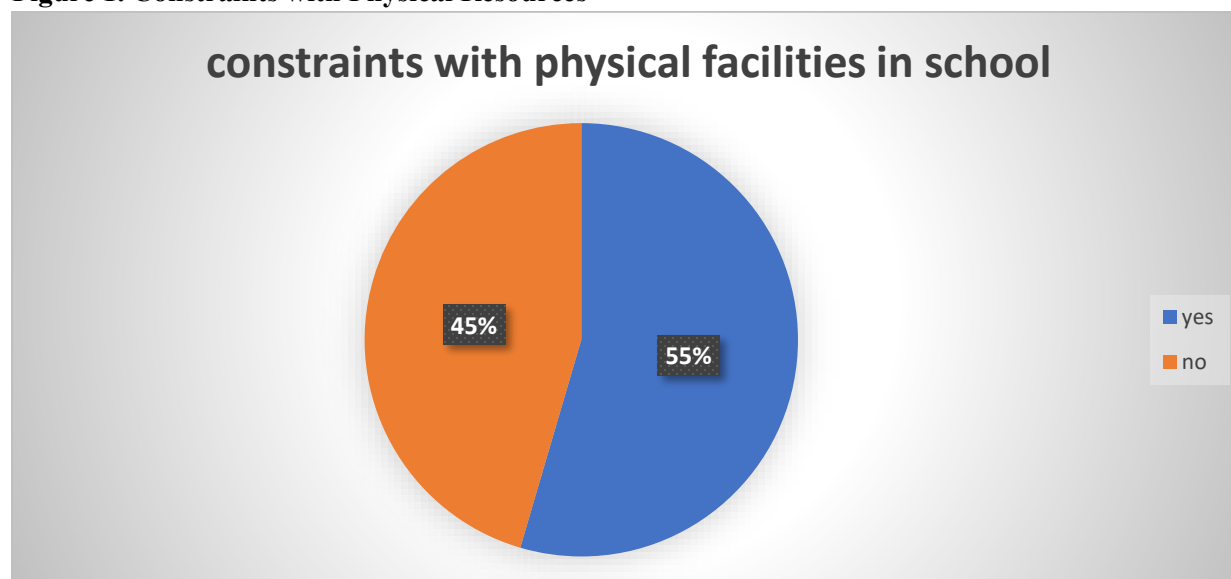
Another respondent indicated that:

*Our school had inadequate laboratories and lacked proper stocking in the library. We have a challenging time when it comes to doing our science practicals and relying on theory alone makes it difficult to comprehend some topics taught in class. The library lacks revision books that we can use to supplement the learning taught in the classrooms.*

These study findings are consistent with those of Zottor, Egyir & Anaman (2022), who indicate that inadequate libraries, crowded classrooms, and the inability to use laboratories due to insufficient equipment are some of the constraints that schools face.



**Figure 1. Constraints with Physical Resources**



**Source:** field data (2024)

### Equipped School Library

Figure 2 below, 68.1% of the students, 35.6% of teachers, and 55% of principals did not think the library influenced the students' KCSE performance. The figure also shows that 31.9% of the students, 64.4% of the teachers and 45% of the principals indicated that having a library impacted the students' KCSE performance.

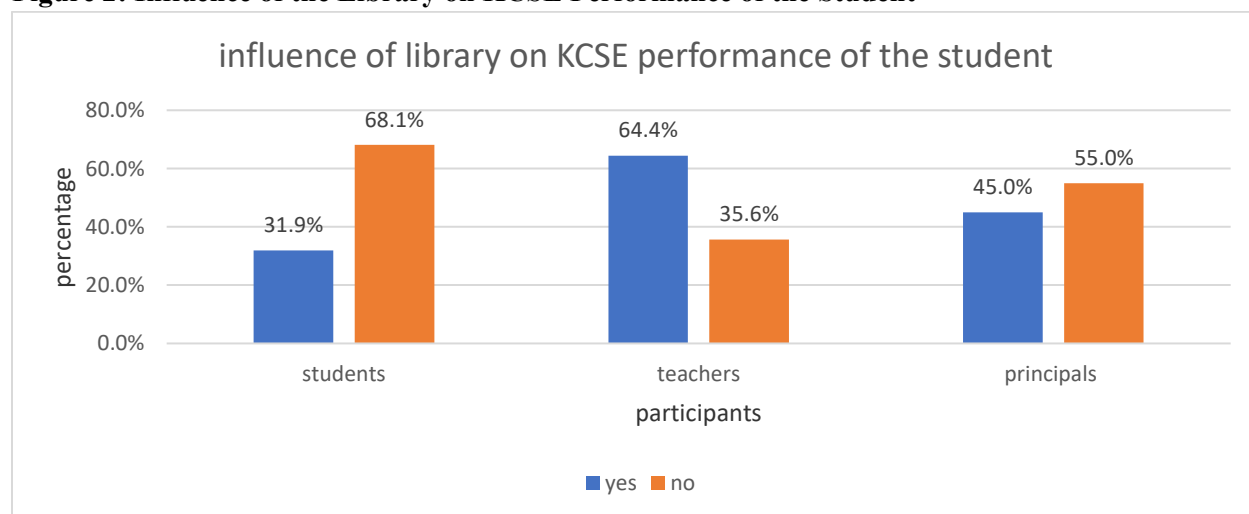
One of the student participants supported the above findings in the open-ended questionnaire by indicating that.

*The library affects KCSE results and the library can be improved by introducing more revision books to the schools.*

One of the teacher participants supported the above findings in the open-ended questionnaire by indicating that.

*The library affects the KCSE performance of the school and in my opinion, it can be improved by making it more spacious and modern to accommodate computers so that more learning resources can be obtained online.*

The study finding is consistent with Ebong, Asodike & Izuagba (2016), who indicated that a library is a significant facility in the school as it directly aids the teaching and learning process. The study findings are consistent with Okoroma and Orike (2019), who report that libraries help students think critically when exposed to textbooks, newspapers, and magazines.

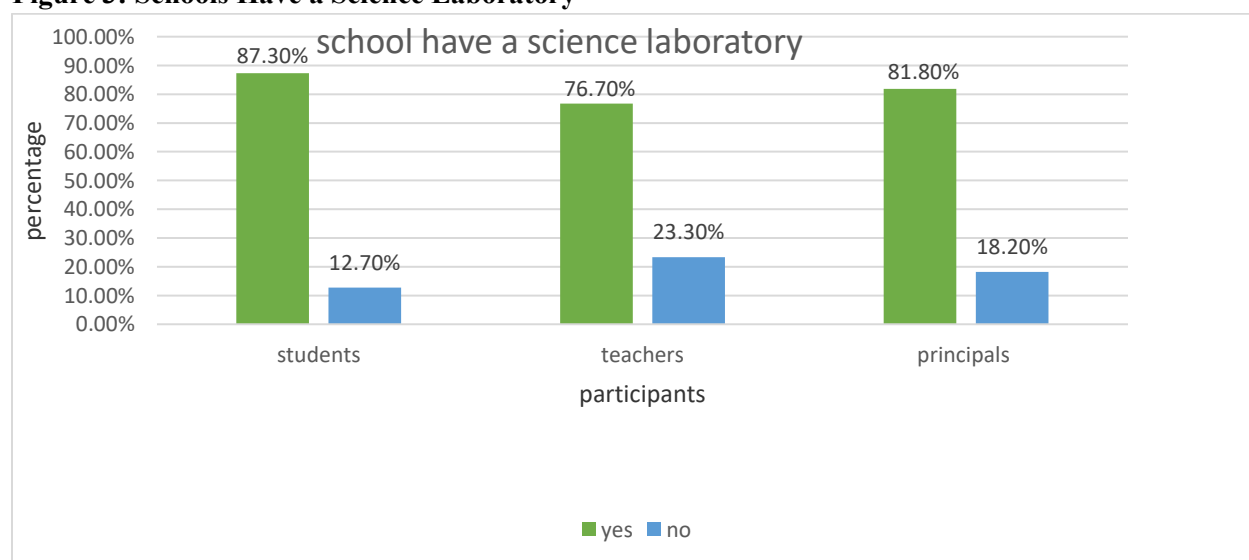
**Figure 2: Influence of the Library on KCSE Performance of the Student**

Source: field data (2024)

### School with Laboratories

Figure 3 below shows that 87.3% of the students, 76.7% of teachers and 81.80% of the principals indicated their schools had a science laboratory, while 12.7 % of students, 23.3% of teachers and 18.2% indicated their schools did not have a science laboratory. The study finding is consistent with

Akungu (2014), who indicates that science labs are some of the essential school infrastructure. Pareek (2019) indicates that a science laboratory helps students better understand what is taught in the classroom, and practical lessons in the laboratories help reinforce the understanding of academic concepts.

**Figure 3: Schools Have a Science Laboratory**

Source: Field data (2024)

The teachers were asked if the science laboratories had any effect on the school's KCSE performance.

According to Table 1 below, 70% of the participants indicated that science laboratories had a great

influence on the school's KCSE performance, 34.9% indicated it had little influence, and 5.6% indicated that it had no influence. One of the teacher participants indicated in the open-ended questionnaire that.

*Science laboratories have a great influence on KCSE performance and they can be improved by equipping them with the necessary equipment.*

**Table 1: Influence of Science Laboratory on KCSE performance**

		Frequency	Per cent	Valid Percent
Valid	A Little Influence	21	34.9	34.9
	Great Influence	64	70.0	70.0
	No Influence	5	5.6	5.6
	Total	90	100.0	100.0

**Source: field data (2024)**

The students were asked about the importance of science practicals on the school's KCSE performance. According to Table 2, 81.9% of the students indicated that science practicals were very important as they affected the school's KCSE

performance, while 12.1% indicated that they were important. 0.9% of the students indicated that science practicals were not important in the school's KCSE performance.

**Table 2: Importance of Science Practical**

		Frequency	Per cent	Valid Percent	Cumulative Percent
Valid	Important	56	12.1	12.1	12.1
	not important	4	0.9	0.9	12.9
	slightly important	24	5.2	5.2	18.1
	very important	380	81.9	81.9	100.0
	Total	464	100.0	100.0	

**Source: field data (2024)**

Both study findings are consistent with Pareek (2019), who indicates that practical science lessons enable students to understand and recall concepts. The findings are also consistent with Mulinge (2017), who indicates that exposure to practical lessons promotes the performance of students in national examinations. The findings are consistent with Lucas & Mbiti (2014), who indicate that inadequate school laboratories contribute to declining KCSE performance.

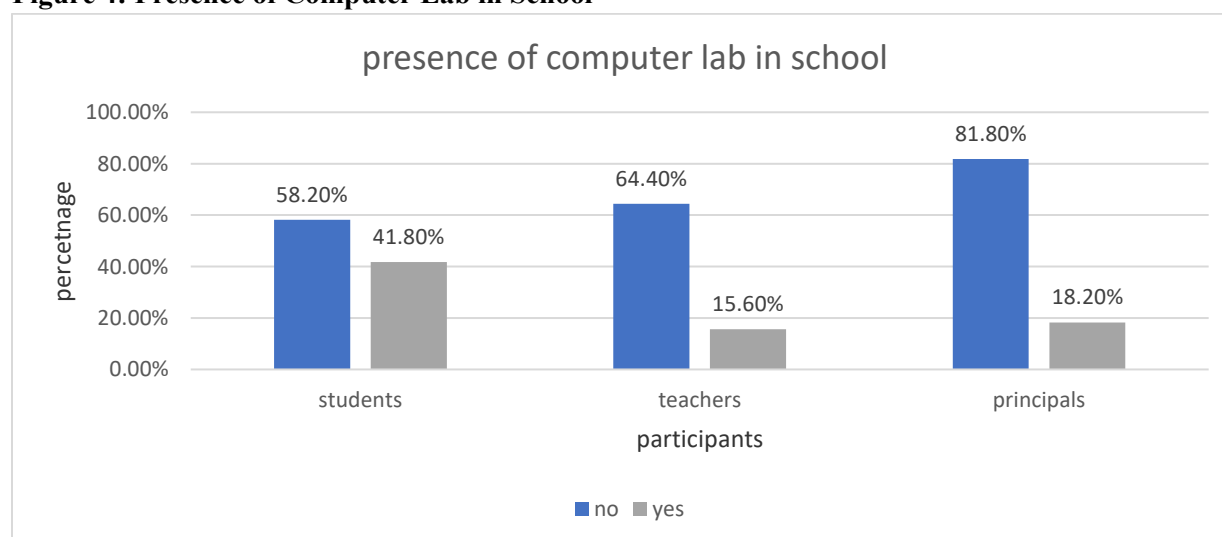
### Availability of Computer Laboratory

Figure 4 below indicates that 41.8% of students, 15.6% of teachers and 18.2% of principals had a computer lab in their school, while 58.2% of

students, 64.4% of teachers and 81.80% of principals indicated that they did not have a computer lab in their school. The study findings are consistent with Akungu (2014), who indicates that computer laboratories are essential school infrastructures. According to the study, the students used computer labs for computer lessons, other lessons, research, revision and entertainment. However, one of the student participants indicated that.

*We face challenges when using computer laboratories because the electricity goes off while using the computers.*



**Figure 4: Presence of Computer Lab in School**

Source: field data (2024)

Table 3 below shows that 68.5% of the participants never used their school's computer for academic research, 19.2% rarely used it, and 12.3% often did. Low usage of computers for academic research portrays a critical gap in the integration of technology within the academic environment. The

researcher observed an inadequate computer literacy trend among students and the lack of engagement could hinder the students' capacity to access academic research materials that could help in improving their KCSE performance.

**Table 3: Use of Computers for Academic Research**

		Frequency	Per cent	Valid Percent	Cumulative Percent
Valid	Never	318	68.5	68.5	68.5
	Often	57	12.3	12.3	80.8
	Rarely	89	19.2	19.2	100.0
	Total	464	100.0	100.0	

Source: field data (2024)

Table 4 below shows that 32.3% of the participants indicated that computers and other ICT equipment did not affect their performance. 28.9% indicated that computers and ICT facilities greatly affected

their performance, while 22.4% indicated it had a moderate effect. 16.4% indicated that this equipment had a slight effect on their performance.

**Table 4: Use of Computers and Other ICT Equipment**

	Frequency	Per cent
great effect	134	28.9
moderate effect	104	22.4
no effect	150	32.3
slight effect	76	16.4
Total	464	100.0

Source: field data (2024)

### Summary of the Findings

The study established that the schools in the region experienced constraints with physical facilities. Some schools did not have science and computer laboratories and libraries, among other facilities. Others encountered inadequate stocking of the laboratories and library facilities, which limited students' options for reference materials, lab equipment and reagents.

Secondly, the study concluded that libraries had an impact on the students' KCSE performance. The students, teachers, and principals who participated in the study indicated that libraries assisted in the teaching and learning process.

Third, the study established that science laboratories were among the essential school infrastructure as they reinforced the understanding of academic concepts. The teacher participants also indicated that science laboratories greatly influenced the KCSE performance in school. The students indicated that science practicals were very important as they affected their KCSE performance.

Fourth, the study concluded that computer and ICT facilities had a great effect on the school's KCSE performance. These facilities helped the students conduct academic research and revision.

### CONCLUSION OF THE FINDINGS

Physical resources such as science and computer laboratories and libraries influence KCSE performance. The study concluded that most schools in the region do not have these physical resources. The schools that have these physical resources experience inadequate stocking, which is important in their science subjects.

### Recommendations of the Study

- The schools in Kakamega Central Sub-County can engage in a resource-sharing network between schools that have facilities and those that lack them. This will help all the students in the region participate in practicals.

- Schools could also seek alternative funding through grants and investment partners to help build and equip libraries, science laboratories and ICT facilities.

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