

Impact of Library Resource Utilization on Secondary School Students' Performance in Chemistry at Uasin Gishu County, Kenya

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Abstract

The strategic use of teaching-learning resources sparks curiosity among learners while adept use of scientific tools enhances student engagement and boosts academic performance. This contradicts the current state where students' performance in chemistry has been dismal for some years. The paper examined the relationship between the use of library resources and students' academic performance in Chemistry. This study was conducted at Kesses Sub-County, Uasin Gishu County, Kenya. Correlation research design was used while education production function formed the theoretical basis for this study. Questionnaires and document analysis were used to collect data. The target population was 43 school principals, 70 chemistry teachers and 2530. Form three students and the sample units were 14 principals, 14 chemistry teachers and 148 students. Data collected was analyzed by the aid of Statistical Package for Social Science (SPSS-Version 26). Regression results of influence of library facilities on chemistry performance showed easily accessibility of chemistry reference books was negative and statistically significant at -0.277 ($p < 0.05$), implying that provisioning accessibility of students to library facility doesn't guarantee improved chemistry performance. However, the significance of a random factor, which explains unobserved and/or omitted variable in OLS regression models were found to be critical for consideration for improved chemistry performance in schools. Hence, further investigation is recommended. The study recommends investment by schools through the provision of chemistry books and teachers guides.

Keywords

Utilization, Library, Resources, Performance, Student Achievement

1. Introduction

Acquisition of knowledge in chemistry presents theoretical bases for synthesis of drugs which is utilized in the manufacturing industries. Conceptualizing chemistry knowledge at secondary school education levels forms a foundation for learners and future professionals that are needed in manufacturing processes. To meet the demands of professionals needed to handle industrial work that requires chemistry knowledge, utilization of teaching-learning resources at secondary education level, which perhaps could lead to high performance in Kenya Certificate of Secondary Education (K. C. S. E), is a prerequisite. Improved K. C. S. E performance in the subject can also lead to an affective manufacturing process. This is a catalyst of wealth creation, social welfare and international competitiveness from quality chemical products.

Disciplines such as medical, pharmaceuticals and other science related courses, require the students to be well equipped with chemistry knowledge in order to improve the medical sector, which is key to every country's development. This depicts a situation that requires a continuous flow of students and graduates to build human capacity in areas that need scientific knowledge related to chemistry (Igbonugo, 2014). Therefore, chemistry education, being basic and the foundation of synthesis and conceptualization of chemistry as subject by aspiring professionals' and learners, its high performance in Kenya Certificate of Secondary Education (KCSE) is paramount in defining future careers and development of industrial processes in manufacturing industries (MOEST, 2014). Performance in Chemistry refers to the standards expected from those activities that relate to teaching and conceptualization of Chemistry knowledge by learners (Smith, 2016).

In developed nations library play a critical role in science based subject performance. In united states of America, AASL (2022) report indicates school libraries as pivotal in fostering scientific inquiry where students can access diverse resources like digital databases, e-books, and other learning resources which are key in fostering scientific concepts and critical thinking skill.

In Africa, particularly Nigeria, Akintunde and Afolabi (2023) depict the lack of well-equipped libraries. The secondary schools with libraries had few and outdated learning resources where the status of these libraries has tremendously affected students' engagement with the scientific knowledge. These disparities require serious interventions across Africa in order to ensure equitable access and provision of the library resources which is important in improving science performance. In Tanzania studies have revealed disparities in the distribution of learning resources. Most school libraries lacked access to internet services, this limits teachers and student exposure to scientific knowledge which would boost the performance in science subjects, the study further revealed the unavailability of supplementary books in the library could be the reason for the continued poor performances in science subjects. (Kanwera et al., 2024). In Kenyan context the Kenya Certificate of Secondary Education (KCSE) examination is a key determi-

nant of the students' future career, hence making educationists and several researchers to incline their researches towards library resource as a component towards improving academic achievements (Almulla & Khasawneh, 2024).

A study by Diki M. et al. (2025) indicates a positive correlation between the student achievement in K. C. S. E and the library resource utilization. The library factors such as availability and adequacy of library resources such as textbooks, reference books and digital materials promoted better student engagement which in turn improve their academic outcomes.

As illustrated in **Table 1**, the Kenya National Examination Council results at the National level is below the expected average mark which shows a worrying trend towards the achievement of the National goals. The same results are replicated at the Sub County, with an average mean of 2.8 (33.3%) which is a mean grade of D (Kesses Sub County, 2019). The learners' output is lower than the National University entry grade which is a C+, required for an individual to pursue a career course related to chemistry. This means few students attain the national university entry minimum qualification. The same downward trend was replicated in the sub-County of Kesses where the Chemistry K. C. S. E performance was low.

Table 1. KCSE chemistry performance nationally (2019-2022).

Year	Candidature	Maximum score	Standard Deviation	Mean score
2019	691,802	200	32.71	33.29
2020	704,831	200	30.19	34.01
2021	802,765	200	28.01	27.84
2022	875,555	200	30.18	33.45

Source: KNEC report 2023.

2. Literature Review

Chemistry is one of the major science subjects being taught for innovation and revolutionization of industrial processes, which is aimed to enable learners to acquire knowledge of chemical reactions in order to understand physical environment, develop scientific concepts, principles and skills. Again, it helps the learner to acquire problem-solving skills for future training for careers and appreciating the responsibilities as chemist in society (KNEC, 2019). Learning Chemistry like other disciplines utilizes different methods of instruction. These methods include; lecture question and answer technique, field trip or fieldwork, class demonstration and student practical work that greatly improves student performance (Isa et al., 2020). All the teaching approaches aims at equipping the learner by bringing a positive change from their interaction between knowledge supplier of chemistry and learner.

Kenya's Vision 2030, which is portend with Millennium Development Goals, views science subjects, especially chemistry as an enabler and one of the pillars for

the achievement of industrialization (Macheso, 2025). This is contrary to the current trends where chemistry performance has been dismal over the years in Kenyan secondary schools, thus hindering the achievement of development goals.

Several studies have blamed the underutilization of teaching-learning resources for stymieing students' chemistry performance in secondary schools and tertiary colleges (Hassan et al., 2015). The school library is a collection of books and media that allows learners to inculcate knowledge. Again, the library enables the learner to access learning resources through the provision of physical and digital platforms such as use of class textbooks, guiding materials and reference resources (Habibillah et al., 2022). Apart from being a place of getting learning materials, the library also provides a conducive environment for studying where students can utilize the room for personal studies, doing assigned class work or preparing for examination.

A study done in Philippines on library resource utilization depicted a positive correlation between the student frequent use of library resources and their achievements (Estrada et al., 2023). Library is a major source of information which boost the student's academic performance and achievement (Rodrigues & Mandrekar, 2020).

The study of Carvalho and Mandrekar (2020) on the student level of satisfaction with the use of library resources and services and academic performance shows that the library plays a vital role in improving the students' performance. Rehman et al. (2020) found the availability of under-equipped libraries learning resources in most Pakistan colleges. A similar situation was observed in Iran, where the library resources were not provided in most of the institutions leading to negative impact on student performance.

Wong and Webb (2011) analyzed data from over 8000 graduates of Hong Kong Baptist University to investigate the relationship between the number of books and audiovisual resources borrowed during a student's academic program and their final GPA. Their research revealed a positive correlation between the use of these library resources and graduation GPA in 65 percent of the total student population. This study concurred with a study at Huddersfield University (U. K.), which involved over 20,000 students from first to fourth year. The study examined library visits, electronic resource usage, and book borrowing. Findings suggested that students who engaged more with electronic resources and borrowed more books tended to achieve higher grades.

Silva N. D. (2024) depicted student's use of library facilities for reading and research in a situation where the surrounding environment fails to provide a silent reading space while the students with a silent environment do not require the use of a physical library as they can use online libraries for their studies. This clearly explains the importance of a library facility for boosting academic performance.

School libraries form the basis of successful learning process at all levels of education. As such, among the Vision 2030 aims is quality education sector that is competitive and that provides sustainable development through research and

training (Wambua et al., 2018). According to School Library Impact Studies <http://www.lrs.org/data-tools/school-libraries/impact-studies/>, equipped quality libraries having well laid programs, support staff as well as competent librarians are key building blocks of the students' academic achievement. For instance, research findings from the study of Malach (2020) on the availability and utilization of school resources on students' academic achievement, revealed that library resources had a positive relationship with students' academic performance. However, underutilization impedes their optimal output. Well-equipped library programs and facilities provide avenues for students from economically challenged backgrounds to showcase their academic potential and better their chances to excel. School libraries, apart from supporting academics, also provides personal development to students (Bundy, 2006; Wambua et al., 2018).

As pointed by Molaudzi (2020), a well-equipped library tends to improve collaboration between teachers and librarians as a unit in providing students with basic learning information in their respective subjects under study. Again, a study by Montenegro et al. (2016), investigated the association between the utilization of library facilities and learners' outcomes at the University research-centered in Chile. Further, elaborative findings from the research showed that the use of library resources had the propensity to positively influence learning outputs. In addition, library resources provide access to exogenous knowledge and extra information that supplement classroom teachers' notes and other designed course books (Montenegro et al., 2016). Furthermore, a study by Ngera et al. (2023) on library resource as a predictor of learners' outcomes showed the presence of reference books and proper use of library facilities had a positive effect on the student's performance in physics subject, thus the need to expose the learners to the available library resources to enable them to attain maximum benefit in order to improve their learning outcomes.

A study by Wambua et al., (2018) on the availability of a school library and pupils' performance in social studies revealed the library as one of the vital facilities in lower primary schools that positively impacted student performance. Despite its importance, none of the schools had a library facility. Most schools stored their books in head teachers' offices, while others had simple structures within their classrooms where learning resources were stored. This study was in lower primary schools the current study was conducted in secondary schools.

Mutungi et al. (2014) found that the Kenyan government provides minimal assistance toward the establishment of functional libraries, despite being a basic necessity in schools. This makes respective schools circumvent the challenge by establishment of their own libraries. Furthermore, research findings showed nearly 84% of schools in Nairobi County had established libraries from their own initiatives. Libraries had few learning resources majorly print books, with inadequate digital content.

These studies did not look at the availability and utilization of library resources in both public and private schools, thus creating knowledge gap that this current

study will bridge by seeking the extent of utilization of libraries in both public and private schools. Again, another gap was that the cited literature failed to relate the utilization of libraries with students' academic performance, this current study does.

3. Methodology

Correlation Research Design was used to depict the relationship between library resources and student's chemistry academic performance in Kesses Sub-County, Uasin Gishu County, Kenya.

The total number of secondary schools in the subcounty were 43 of which 38 were public and the remaining 5 were privately owned. The students targeted in this study were all Form three students with a population of 2530 who studied chemistry with their teachers in the 43 public and 5 private Kesses Sub-County Secondary schools in Kenya.

A sample of between 10 and 30 percent was selected since it was deemed adequate for a population of below 1000 (Mugenda, 2009). A proportion of 30% was applied in selecting sample units of the 43 schools, which were clustered as 32 mixed public schools, 3 Girls' public boarding, 3 Boys' public boarding, 3 mixed private schools and 2 boys' private in the study area, giving a total of 14 secondary schools.

The student respondents were selected using systematic simple random sampling. The class list formed the basis of respondent selection, with the first student forming a reference point. Subsequent student selection was based on prorated interval of 10% of the student population resulting in a total student sample of 148 students.

From the 14 secondary schools, all the headteachers and 14 Form three Chemistry teachers were purposively selected. From the students, Chemistry teachers and headteachers samples, the total number of respondents for this study was 176.

Data collection tools were both open-ended and closed-ended. Again, observation checklists tool was designed to authenticate the data reliability from students' questionnaires. The significance of observation list was to check the consistency of information sought, and to clarify unclear information from primary data collection tools.

To determine influence of the selected independent variables on the performance of chemistry, inferential tests using OLS regression analysis was performed. The influencing variable selected in this study that formed part of regression model estimators were: adequate chemistry books, easily accessibility of chemistry books and adequate chemistry teachers' guide, while students' performance in chemistry was the dependent variable. The scoring questions were designed in the students' questionnaires. The scoring level used was Strongly Disagree (SD), Disagree (D), Agree (A), and Strongly Agree (SA), with each score assigned a value of 1, 2, 3 and 4, respectively. The scores from students, which formed part of data to be analyzed, were transformed into natural logarithms to

allow ease interpretation from regressed data. The equation function used in this study that illustrated OLS regression model is defined as follows:

$$\ln SP = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \dots + \beta_n \ln X_n + \varepsilon_i$$

where: $\ln SP$ -natural log of student performance, β_0 -constant value of the regression model, β_1, \dots, β_n -coefficient value of the selected predictor variables, $\ln X_1, \dots, \ln X_n$ -natural log of predictor variables and ε_i -error term of the model.

Correlation Research Design was used to depict the relationship between library resources and student's chemistry academic performance in Kesses Sub-County, Uasin Gishu County, Kenya. Then data analysis was conducted using Excel and the Statistical Package for Social Sciences (SPSS) version 26 to generate results in tabular and/or chart form from data frequencies and percentages.

4. Results and Discussion

The purpose of this study was to establish the effect of the utilization of library teaching-learning facilities on students' chemistry academic performance in Kesses Sub-County, Uasin Gishu County. The study hypothesized that there is no statistically significant relationship between the use of library resources and students' academic performance of chemistry in Kesses Sub-County.

Table 2 describes the perception of head teachers, teachers and students on the use and influence of library learning resources on students' academic performance.

Table 2. Respondents' perception on utilization of library learning resources.

Variable	Attitude											
	Head Teachers				Teachers				Students			
Library	SD	D	A	SA	SD	D	A	SA	SD	D	A	SA
Chemistry	F 3	1	6	2	1	3	6	4	43	31	47	24
References	% 25.0	8.3	50.0	16.7	7.1	21.4	42.9	28.6	29.1	20.9	31.8	16.2
Easily	F 3	2	5	2	4	1	5	4	47	35	41	23
Accessible	% 25.0	16.7	41.7	16.7	28.6	7.1	35.7	28.6	31.8	23.6	27.7	15.5
Teachers	F 3	2	5	2	1	2	5	6	19	22	67	37
RTG Guide	% 25.0	16.7	41.7	16.7	7.1	14.3	35.7	42.9	12.8	14.9	45.3	25.0

Source: Author. **Note:** **F** = represent frequency; **%** = represent percentages from frequencies from Likert Scale of Strongly Agree (SA), Disagree (D), Agree (A) and Strongly Agree (SA).

Library facilities, from the results in **Table 2**, are perceived as a significant component that aids students' performance, as depicted by most of the respondents who inclined to agree. Those library facilities such as presence of chemistry reference books and teachers guides, and accessibility of libraries in temporal scale to significantly improve chemistry performance. However, head teachers and teach-

ers perceived indifference. This implies that accessibility of chemistry reference books and teachers guide is mandatory for students to perform better in chemistry. This finding is in agreement with Wambua et al. (2018), the study depicts library facilities plays a crucial role in improving the student academic performance where children from the low socio-economic backgrounds showed better performance on the use of library facility for reading (Rodrigues & Mandrekar, 2020); also shows library being the major source of information for boosting the student's academic performance and achievement.

Table 3 shows the relationship tests between the utilization of selected library facilities that are perceived to influence student s' performance in chemistry.

Table 3. Relationship tests between variables of library facilities that influences chemistry performance.

Variables	1	2	3
1) Chemistry Reference Books	1	0.560*** (0.000)	0.350*** (0.000)
2) Easily Accessed Referenced Chemistry Books		1	0.338*** (0.000)
3) Adequate Teachers Guide			1

Source: Author; **Note:** Significant values (p -values) are in parenthesis; * $p < 0.1$; AQ** $p < 0.05$; *** $p < 0.001$.

From the results, all pairs of the selected variables showed to be positively correlated and statistically significant at ($p < 0.001$), suggesting that the selected variables used to profile library use in this study were validly selected and strongly associated. Also, the fact that all the selected variables that describe functional library were positively correlated in this study, suggests that they influence better students' performance in chemistry if used appropriately. However, their degree of relationship except for between presence of reference and its accessibility at (0.560, $p < 0.001$) showed to be weak, suggesting that their relationship could have a different meaning.

The causal effect of selected library facilities on students' chemistry performance in this study was analyzed using OLS regression tests. The dependent variable in the regression analysis was students' KCSE chemistry performance, while predictors in the model were identified library resources such as adequate chemistry books, easily accessibility of chemistry books and adequate chemistry teachers' guide as illustrated in **Table 4** below.

Table 4. Results of statistical tests of library materials on KCSE chemistry performance.

Variables	(β_i)	(R)	S. E	t-test	Significance
Constant	2.850				
Adequate Chem Ref Books	0.180	54.5%	0.118	1.532	0.128

Continued

Easily accessed Chem Books	-0.277	43.1%	0.117	-2.376**	0.019
Adequate Chem Teachers Guide	0.117	52.9%	0.117	0.998	0.320
Error Term	1.000	73.1%	0.018	55.814	0.000
Adjusted R ²	0.023	-	-	-	-
F value	-	-	-	2.132	0.099

Source: Author; **Note:** n = 148; $P(i)$ = Logit model values; S. E = Standard error; Significance level (p -values) is in parenthesis *** $p < 0.001$, ** $p < 0.05$ and * $p < 0.1$.

Results from analyzed model predictors of library facilities on students' chemistry performance. Depicted results of F-tests (ANOVA), which showed to be statistically significant at 2.132 at significance level of ($p < 0.1$) in **Table 4**, portray goodness of fit in the model and/or perfect fit. This means that the selected exploratory variables in this study that profile utilization of library facilities for better students' chemistry performance were sufficiently explained by the model. Despite its statistical significance, however, the confidence level was lower at the 90% level, which suggests the existence of inherent factors that remain unobserved in the model. This creates further arguments regarding whether enough variables were selected. Again, the R square value of 0.023, which reveals that the selected predictors in the model explain 2.3% of the students' performance in chemistry, while about 97.7% remained unexplained. This low adjusted R square value, points out the existence of insufficient explanation of the selected library facilities in influencing students' performance in this study. This study finding of low R square value explains the existence of other influencing variables like teacher quality, laboratory work, socioeconomic status which are beyond the scope of this study. Hence, the need for future studies to incorporate other possible variable that influences students' chemistry performance.

Despite other variables such as adequate chemistry reference books and teachers guide showing to be statistically insignificant at (0.180, $p < 0.128$) and (0.117, $p < 0.320$), respectively, however, their directions of influence as depicted by the regression coefficients are critical in decision-making by school managers. The positive coefficient values imply that the presence of chemistry books and teachers guides in the library could improve students' performance at marginal scale. Therefore, this gives a signal to the school managers and teachers on the importance of availing library facilities to learners.

These study findings mirror the findings of [Mugure \(2012\)](#), who found inadequacy of library resources in most schools in Muranga County, Kenya. For instance, while assessing utilization of library resources, the findings by [Mugure \(2012\)](#) showed that most schools had few library spaces which forced them to improvise other rooms as Library space. In particular, a study by [Wambua et al. \(2018\)](#) found none of the schools had library facilities; instead, most books were stored in head teachers' offices or simple structures within the classrooms. Again,

a study on existence and use of school resources on students' achievements by Malach (2020), found library facilities positively influencing students' academic performance. Despite the existence of relationship, however, students' academic achievements were low, which could be attributed to underutilization of the available library resources among the selected schools. Therefore, these past studies (Mugure, 2012; Wambua et al., 2018; Malach, 2020) support in part, the finding of this study.

Further the study tested the null hypothesis:

H₀: *There is no statistically significant relationship between the use of library resources and students' academic performance in chemistry.*

To tests whether there exists any statistically significant relationship between the use of library resources and student's academic performance in chemistry, the null hypothesis was tested using Pearson Correlation Coefficient Tests. The statistical significance level (p -value) was set at 0.05. The magnitude of p -value from statistical tests less than 0.05 prompts the null hypothesis to be rejected. This means there is existence of statistical significance variations of means of laboratory apparatus and reagents that influence students' performance in chemistry. Again, magnitude of p -value that is larger than 0.05 suggests the inexistence of a significant difference of selected library facilities to influence students' chemistry performance, which prompt the null hypothesis not to be rejected. Table 4 shows correlation test results between laboratory apparatus and reagents and students' academic performance in chemistry.

The hypothesis testing result in Table 5 showed positive and statistical significance correlation ($r = 0.209$, $n = 144$, $p = 0.05$) between the use of library resources and students' academic performance in chemistry. Based on the statistically significant from the correlation tests related to the hypothesis testing that "*There is no statistically significant relationship between the use of library resources and students' academic performance in chemistry*". The study's null hypothesis was rejected. Based on hypothesis testing results, it is logical to conclude that there is statistically significance variation of means between the usage of library resources and students' academic performance in chemistry.

Table 5. Summary of relationship tests between library facilities and students' KCSE chemistry performance.

		Library Facilities	Students' chemistry Performance
Library Facilities	Pearson Correlation	1	0.209*
	Sig. (2-tailed)		0.012
	N	144	144
Students' chemistry Performance	Pearson Correlation	0.209*	1
	Sig. (2-tailed)	0.012	
	N	144	148

** . Correlation is significant at the 0.05 level (2-tailed).

5. Conclusion

The relationship tests between components of the library such as adequate chemistry reference books, accessibility of reference books in school library and adequacy of teachers' guides, showed positive correlation, though, their degree of relationship was weak. This could mean that their relationship could have a different meaning; therefore, further in-depth analysis is needed. Furthermore, the negative and statistically significance of easily accessed chemistry reference books suggests impeding students' performance. That is, inaccessibility of chemistry reference books is a critical impediment to the students, which perhaps signals the need for schools to make reading material available in order for the students to improve their performance.

The result of positive effect of Library facilities on chemistry performance by students, although insignificant, suggests that it is a critical facility that secondary schools need to have in order to realise better academic performance. Therefore, it is logical to conclude that the provision of chemistry books and teachers guides influences students to improve performance in chemistry.

6. Recommendation

1) Formulation of a policy that enables government and educational stakeholders to avail reading materials. This was based on the study findings which showed that reference books and teachers guides were statistically significant; hence, being critical in influencing performance for students in chemistry.

2) There is need for the formulation of a policy that mandates all secondary schools to have library infrastructure equipped with reading materials and internet availability.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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