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Students Performance in Biological Sciences: Showcasing Kuresoi South Sub-County, Nakuru County, Kenya

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Abstract

This research article delves into the critical subject of resource disparities and their impact on students' academic success in Biology with particular reference to the day secondary schools in Kuresoi South Sub County, Nakuru County, Kenya. Against the backdrop of persistent challenges in Mathematics and the sciences, notably Biology, in the Kenya Certificate of Secondary Education (KCSE) examinations, this research thus seeks to scrutinize the multifaceted dimensions of resource availability. Employing the General System Theory (GST) as the theoretical framework that informs it, it embraces quantitative and qualitative methods to explore the influences of human resources, teaching and learning resources, library facilities, and biology laboratories on students' Biology performance. The findings underscore the global issue of uneven access to quality educational resources, emphasizing a stark contrast between well-equipped institutions and those grappling with resource limitations. Teachers highlighted the pivotal role of qualified Biology educators in shaping student outcomes, though concerns surfaced regarding resource allocation and administrative support. While professional development opportunities were acknowledged as beneficial, it vouches for targeted improvements. The significance of multimedia resources and technology in enhancing engagement signifies the evolving role of technology in the educational landscape. Despite resource challenges, a consensus emerged among teachers on the importance of conducive classrooms and supplementary teaching aids for effective Biology studies and instruction.

Keywords: Evaluation, influence, resources, performance, biology, students, secondary, schools

Introduction

Access to quality resources is crucial for students' academic success, particularly in science subjects such as biology. Across the globe, disparities in resource availability exist among secondary schools, with some institutions equipped with state-of-the-art laboratory equipment, up-to-date textbooks, and ample learning materials, while others struggle with limited access to these resources (UNESCO, 2020). These disparities often correlate with socioeconomic factors, with schools in affluent areas typically enjoying better resources than those in underserved communities (World Bank, 2018). Consequently, students in well-resourced schools tend to have greater opportunities for hands-on learning experiences, access to diverse educational materials, and exposure to modern teaching methodologies, all of which contribute to enhanced academic performance in biology (McDonnell, 2017).

In contrast, students in schools with inadequate resources face numerous challenges that impede their learning outcomes in biology. Outdated textbooks, insufficient laboratory equipment, and a lack of supplementary learning materials can hinder students' comprehension of biological concepts and limit their ability to engage effectively with the subject matter (Adams & Rose, 2019). Furthermore, disparities in resource allocation exacerbate existing inequalities in educational opportunities, perpetuating a cycle of under-performance among students from marginalized communities (Freeman & Kroll, 2020). Therefore, understanding the influence of resources on students' performance in biology at a global level is essential for identifying areas for improvement and advocating for equitable access to quality education resources worldwide.

Saro et al. (2022) has noted that human resources facilitated learning institutions' teaching and learning process. Collaboration of instructors with other non-teaching staff could lead to a successful teaching and learning process. Examples of human resources include laboratory technicians who assist learners in carrying out practical activities in the laboratory. Teachers, on the other hand, instruct the teaching and learning process. Teaching and learning resources in the Biology instructional process include models, textbooks, charts, and laboratory equipment. The combined effort of human resources in using teaching and learning resources impacts the performance of Biology subject. Effective teaching and learning of Biology depend largely on the teacher and the availability of equipment (Olu-Ajayi, F. E, 2017).

Statement of the Problem

This research study evaluated the influence of human and physical resources on the performance of Biology in Nakuru County, focusing on public day secondary schools in Kuresoi South Sub County.

Purpose of the Research

This research evaluated the influence of resources on the performance of biology by students in day secondary schools in Nakuru County, the case of Kuresoi South Sub-County.

Study Objectives

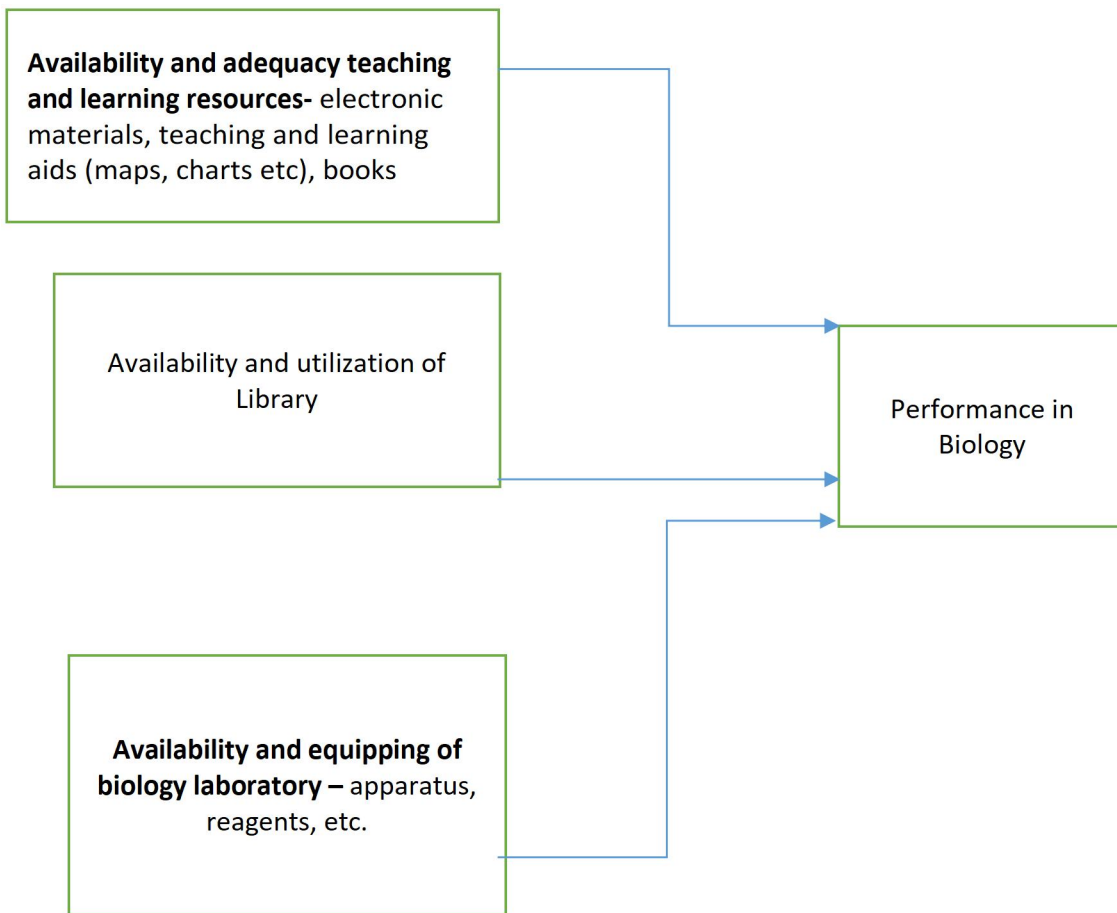
- i. To evaluate how the availability and adequacy of human resources influence the performance of Biology by students in Kuresoi South Sub County, Nakuru County
- ii. To determine how the availability and adequacy of teaching and learning resources influence the performance of biology in students in day secondary schools in Kuresoi South Sub County, Nakuru County
- iii. To assess how the availability and utilization of the library influence the performance of biology in students among day secondary schools in Kuresoi South Sub County, Nakuru County.
- iv. To examine how the availability and equipping of biology laboratory influences the performance of biology and other physical sciences among the students in day secondary schools in Kuresoi South Sub County, Nakuru County.

Literature Review

Adewale et al. (2016) researched Academic Biology Performance at Secondary School Certificate Examination (SSCE) on the Influencing Factors among Students in Owerri Municipal of Imo State, Nigeria. His observations are that 80% of teachers in performing schools had undergone professional training compared to 20% of teachers in poorly performing schools who had not undergone professional training in Biology. This influenced the performance of Biology as those with professional training are better placed to offer quality teaching. Most teachers (91%) in Siaya County had a Bachelor's degree or PGDE, while few had a Diploma in Education (Ong'amo et al., 2017). Adewale et al. (2016) also noted that schools doing exemplary well had the lowest teacher/learner ratio at 1:47 compared to schools performing dismally with a ratio of 1:74. Owino (2014) confirmed that most schools lacked a laboratory assistant, which has negatively impacted the performance of science subjects. Research indicated that the availability and adequacy of instructional materials, such as textbooks, play a pivotal role in shaping student outcomes (Padmanabhan, 2018). In the context of public education, the scarcity of textbooks and physical facilities could hinder the educational system's ability to meet evolving demands (Coombs, 1970). Moreover, Owino et al. (2014) demonstrated the crucial role of reference materials, like Biology textbooks, in enhancing student performance, enabling learners to grasp complex concepts and delve into new content independently.

Adeogun (2001) highlighted a strong positive relationship between instructional resources and academic performance, indicating that schools with more materials tend to achieve better outcomes. Additionally, Mwiria (1985) corroborated these findings by asserting that institutions equipped with adequate teaching and learning materials, such as textbooks, are more likely to excel in examinations compared to poorly equipped counterparts. Studies conducted in various countries, including Canada, the USA, Australia, and Uganda, have shown that learners who regularly utilize well-equipped libraries tend to exhibit better academic outcomes than their counterparts who do not access library resources (Hornby, 2010; Wikipedia, 2010; Lonsdale, 2003; Dent, 2006). Effective time management, note-taking skills, and critical thinking abilities are among the benefits attributed to the cultivation of good study habits (De Escobar, 2011; Gettinger and Siebert, 2002). Akeyir et al. (2016) researched the effective utilization of science laboratory apparatus and noted that the instruction process involved nurturing the learner's skills and capabilities that enhanced scientific advancement. Tekalign (2016) researched laboratory equipment in science institutions in Ethiopia.

The research study notes that 33% of schools studied lacked a science laboratory apart from it being a vital requirement during the teaching and learning of science subjects. Adebola (2011) carried out research in Nigeria on the effect of school factors on learner's performance in Mathematics. Zenda (2016) researched factors affecting learner's achievement in sciences in South Africa. According to Okomolate and Adesua (2016), school physical resources refer to the school buildings, classrooms, offices, laboratories, libraries, toilet facilities, and other materials and infrastructures used for students' motivation toward learning.



This is a diagrammatic representation of variables showing the interconnections of the two variables (independent and dependent variables). The research framework considered education as a production system in which individual student

performance was the primary product. Students' performance in Biology is the dependent variable while teaching and learning materials, library, and laboratory are independent variables.

Research Methodology:

Research Design

A mixed study design was employed in this research, incorporating both quantitative and qualitative data collection methods. According to Ngau and Kumssa (2004), the research design encompasses the setup and execution of the study, including the techniques and procedures used to address the research questions.

Study Location

The research was conducted in Kuresoi South Sub-County, located within Nakuru County. According to the 2019 census data, the population within the sub-county was 155,324, covering an area of 211.7 square miles (548.2 km²). It was approximately 71 kilometers from Nakuru county headquarters to the Kuresoi South Sub-county offices in Keringet.

Target Population

The population targeted by this study was located in Kuresoi sub-county, Nakuru County, which comprised of 16 day secondary schools, 32 Biology teachers, and approximately 1,600 students.

Sampling Procedures and Techniques

Schools were sampled within Kuresoi South Sub County to ensure effective representation of the entire sub-county as the study area. A simple random sampling technique was employed by the researcher to recruit Biology teachers and learners. The lottery technique was used to obtain the sample population.

Table 3. 1: Sample Size

Study group	Sample size	Total Population	Percentage (%)
Students	320	1600	20
Teachers	8	32	25
HOIs	8	16	50
KESSHA Chairperson	1	1	100
Total	337	1649	20

Pilot Study

A pilot study was conducted to ascertain and determine the validity and reliability of the research instruments. The pilot testing of the instruments involved three randomly selected schools, which were not included in the main research.

Data Analysis

Descriptive statistics, including counts and percentages, were utilized to summarize and present the characteristics of the data. These descriptive measures facilitated a clear understanding of the distribution and patterns observed in the responses obtained from both teachers and learners. Additionally, the qualitative data obtained from the interview guide was analyzed thematically. Thematic analysis involved identifying recurring themes and patterns within the interview responses, enabling the researcher to uncover insights and interpretations that complemented the quantitative findings.

Research Findings and Discussion:

Influence of Availability and Adequacy of Human Resources on the Performance of Biology by Students in Kuresoi South Sub County, Nakuru County

In the analysis conducted to evaluate how the availability and adequacy of human resources influenced the performance of Biology by students in Kuresoi South Sub County, Nakuru County, Likert scale questions were utilized to gather insights from teachers and students on various aspects related to human resources. These questions covered several dimensions, including

the availability of qualified Biology teachers, the effectiveness of resource allocation, such as textbooks and laboratory equipment, the impact of professional development opportunities, and the level of support from school administration and management. Additionally, the analysis examined the teacher-learner ratio and the presence of laboratory assistants as key indicators of resource availability and adequacy. The results are presented in Figure 4.1.

In Likert Scale Question 1 "To what extent do you agree that the availability of qualified Biology teachers positively impacts student performance in Biology?", the majority of respondents (75%) either agreed or strongly agreed that the availability of qualified Biology teachers positively impacts student performance in Biology. This aligned with existing literature, such as the findings by Adewale et al. (2016), which emphasized the importance of teacher qualifications in enhancing academic performance. The high agreement percentage suggested a strong consensus among teachers regarding the crucial role of qualified teachers in improving student outcomes.

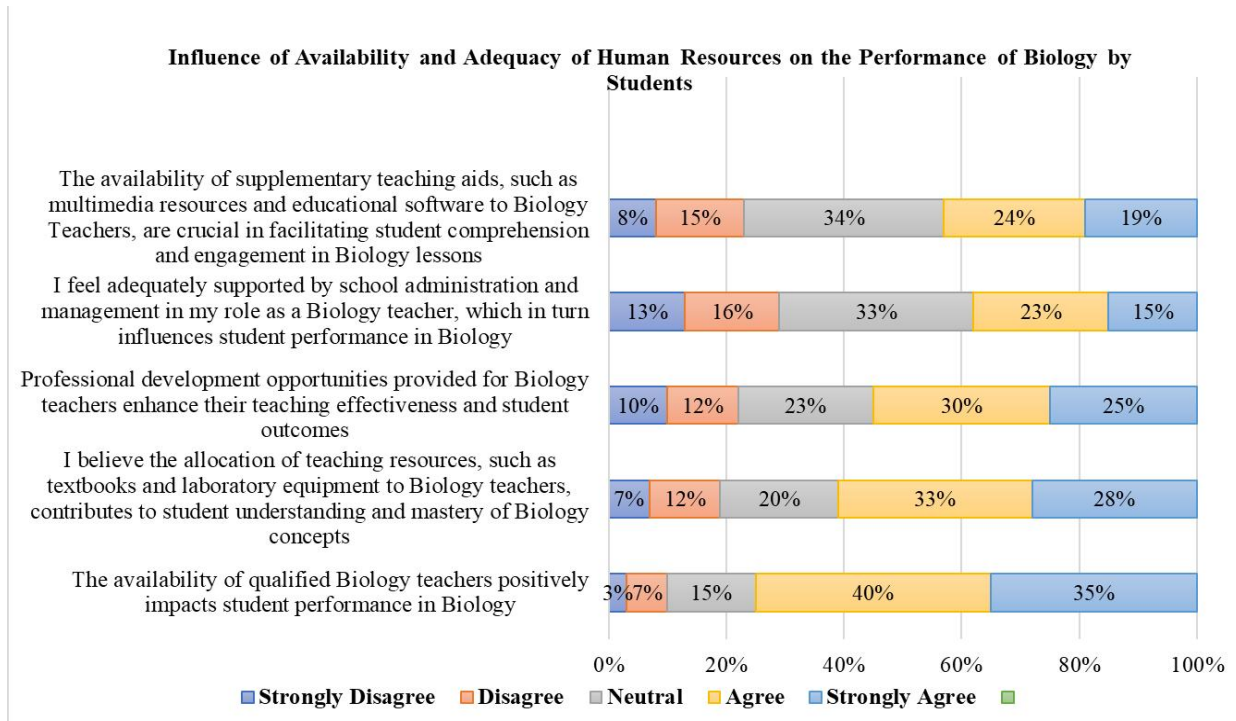


Figure 4. 1: Influence of Availability and Adequacy of Human Resources on the Student Performance in Biology

In Likert Scale Question 2, "How effectively do you believe the allocation of teaching resources, such as textbooks and laboratory equipment to Biology teachers, contributes to student understanding and mastery of Biology concepts?" While a significant proportion of respondents perceived resource allocation as effective or somewhat effective (61%), a notable percentage expressed neutral or negative sentiments (39%). This suggested potential gaps in resource adequacy or accessibility, consistent with literature highlighting challenges in resource allocation (Owino, 2014). Further investigation is warranted to address these challenges and ensure equitable access to quality resources for all students.

Likert Scale Question 3, "To what degree do you perceive that the professional development opportunities provided for Biology teachers enhance their teaching effectiveness and student outcomes? ", revealed that the majority of respondents (55%) perceived professional development opportunities as beneficial, with nearly a quarter considering them extremely beneficial. These findings were consistent with literature emphasizing the importance of professional development in improving teaching effectiveness (Mbaka, 2017). However, further research is needed to identify specific areas for professional development and strategies for maximizing its impact on teaching and learning.

In Likert Scale Question 4, "How adequately do you feel supported by school administration and management in your role as a Biology teacher, which in turn influences student performance in Biology? "While a majority of respondents felt

moderately to fully supported by school administration (71%), a significant proportion indicated insufficient support (29%). These findings echoed literature emphasizing the importance of strong leadership and support structures in fostering an enabling environment for effective teaching (Dhurumraj, 2013). Addressing issues related to support and communication within schools is essential for promoting teacher well-being and enhancing student outcomes.

Lastly, in Likert Scale Question 5, "In your opinion, how crucial is the availability of supplementary teaching aids, such as multimedia resources and educational software to Biology Teachers, in facilitating student comprehension and engagement in Biology lessons?" the majority of respondents (67%) perceived supplementary teaching aids as important to extremely important in facilitating student comprehension and engagement in Biology lessons. These findings highlight the significance of integrating multimedia resources and educational software into Biology instruction, consistent with literature emphasizing the importance of technology in enhancing student engagement (Walker, 2008). However, challenges related to access and utilization of these resources need to be addressed to maximize their effectiveness in the classroom.

Interviews with both teachers and students corroborated the quantitative findings, offering nuanced perspectives on the impact of human resources on academic achievement. During the interviews, one HOI expressed,

"Having qualified Biology teachers makes a huge difference. They bring expertise and enthusiasm into the classroom, inspiring students to excel."

This sentiment aligns with the majority agreement observed in Likert Scale Question 1 regarding the importance of qualified teachers. Additionally, another HOI emphasized,

"While professional development opportunities are beneficial, there's a need for more targeted training to address specific teaching challenges we face."

This sentiment echoes the call for further research highlighted in the quantitative analysis. Students also provided valuable insights, with one HOI noting,

"Access to multimedia resources makes learning Biology more engaging and understandable."

These qualitative perspectives enrich the understanding of how human resource availability and adequacy impact Biology education, emphasizing the multifaceted nature of the issue and the importance of addressing diverse needs to enhance student outcomes.

The analysis of the influence of availability and adequacy of human resources on the performance of Biology by students in Kuresoi South Sub County, Nakuru County, revealed several key insights. Firstly, the majority of respondents recognized the positive impact of having qualified Biology teachers on student performance, highlighting the importance of teacher expertise and enthusiasm in inspiring students to excel. However, challenges were identified in resource allocation, with a significant proportion expressing neutral or negative sentiments regarding the effectiveness of resource allocation in contributing to student understanding and mastery of Biology concepts. This indicates potential gaps in resource adequacy or accessibility that need to be addressed to ensure equitable access to quality resources for all students.

Moreover, while professional development opportunities were generally perceived as beneficial, there was a call for more targeted training to address specific teaching challenges faced by Biology teachers. Additionally, the importance of supplementary teaching aids such as multimedia resources and educational software in facilitating student comprehension and engagement was recognized, although challenges related to access and utilization of these resources need to be overcome. The qualitative insights from interviews with teachers and students further enriched the understanding of these issues, emphasizing the multifaceted nature of human resource availability and adequacy and the importance of addressing diverse needs to enhance student outcomes in Biology education.

Influence of Availability and Adequacy of Teaching and Learning Resources on the Students' Performance in Biology

In the analysis conducted to determine how the availability and adequacy of teaching and learning resources influence the performance of biology in students in day secondary schools in Kuresoi South Sub County, Nakuru County, Likert scale questions were employed to gather insights from teachers. These questions explored various dimensions related to teaching and learning resources, including the availability of laboratory equipment and materials, the effectiveness of textbooks and other learning materials, the adequacy of classroom facilities, the provision of technological resources, and the importance of supplementary teaching aids. The results are presented in figure 4.2.

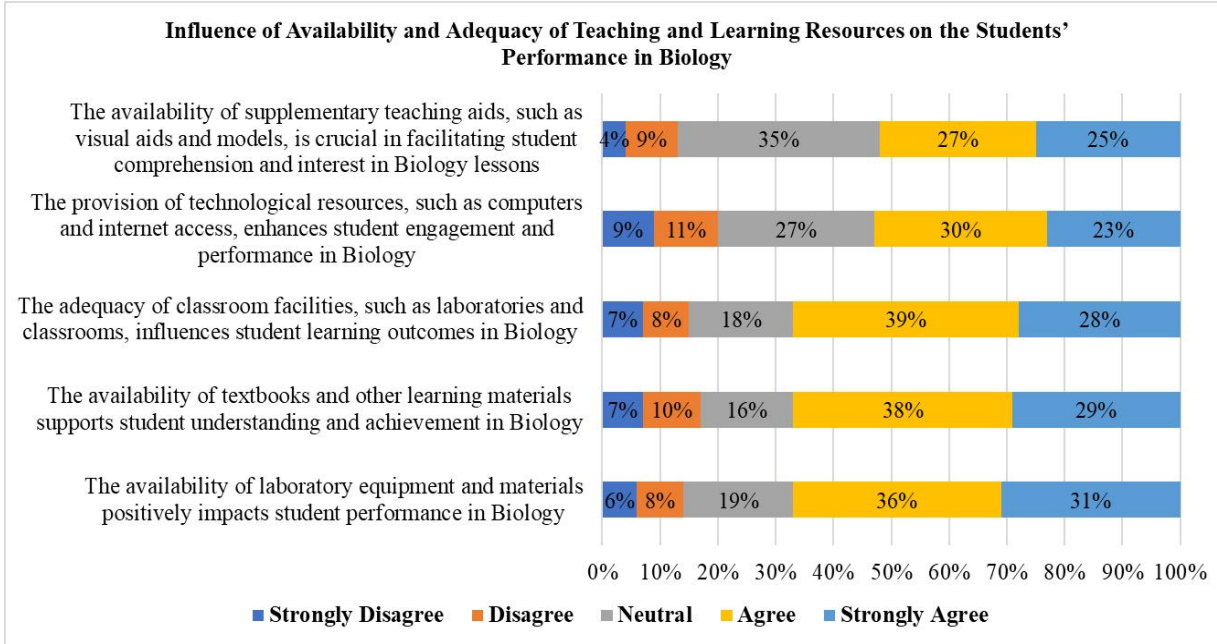


Figure 4. 2: Influence of Availability and Adequacy of Teaching and Learning Resources on the Students' Performance in Biology

In Likert Scale Question 1, "To what extent do you agree that the availability of laboratory equipment and materials positively impacts student performance in Biology?" which assessed the availability of laboratory equipment and materials, 67% of respondents either agreed or strongly agreed that the availability of these resources positively impacts student performance in Biology. This finding resonated with literature emphasizing the importance of laboratory resources in enhancing students' understanding and engagement in scientific concepts (DFID, 2017). The agreement percentage suggested a recognition among teachers of the pivotal role played by laboratory resources in facilitating hands-on learning experiences and reinforcing theoretical knowledge.

Likert Scale Question 2, "How effectively do you believe the availability of textbooks and other learning materials supports student understanding and achievement in Biology?" which focused on the effectiveness of textbooks and other learning materials in supporting student understanding and achievement in Biology. While 67% of respondents perceived resource allocation as effective or somewhat effective, 26% expressed neutral or negative sentiments. This discrepancy underscored potential challenges in resource adequacy or accessibility, consistent with literature highlighting disparities in access to quality instructional materials (Atkinson, 2016). Further investigation is warranted to address these challenges and ensure equitable access to resources for all students, as inadequate materials can hinder effective teaching and learning.

In Likert Scale Question 3, "To what degree do you perceive that the adequacy of classroom facilities, such as laboratories and classrooms, influences student learning outcomes in Biology?" which evaluated the perceived influence of classroom facilities on student learning outcomes, the majority of respondents (67%) indicated that the adequacy of classroom facilities significantly influenced student learning outcomes in Biology. This finding was consistent with literature emphasizing the importance of conducive learning environments in promoting student engagement and academic achievement (Padmanabhan, 2018). The acknowledgment of the impact of classroom facilities suggested a recognition among teachers of the interplay between physical learning environments and student performance.

Likert Scale Question 4, "How adequately do you feel the provision of technological resources, such as computers and internet access, enhances student engagement and performance in Biology?" which examined the provision of technological resources, such as computers and internet access, and its perceived enhancement of student engagement and performance in Biology. A majority of respondents (53%) rated the provision of technological resources as moderately to extremely adequate. This finding underscored the growing recognition of the role of technology in facilitating interactive and innovative learning

experiences (Adeogun, 2001). However, efforts are needed to ensure equitable access to technological resources, particularly in undeserved areas, to maximize their potential benefits in enhancing student learning outcomes.

Lastly, in Likert Scale Question 5, "In your opinion, how crucial is the availability of supplementary teaching aids, such as visual aids and models, in facilitating student comprehension and interest in Biology lessons?" which assessed the importance of supplementary teaching aids in facilitating student comprehension and interest in Biology lessons, 67% of respondents rated supplementary teaching aids as moderately to extremely important. This finding highlighted the significance of integrating multimedia resources and educational software into Biology instruction to enhance student engagement and understanding (Walker, 2008). However, challenges related to access and utilization of these resources need to be addressed to ensure their effective integration into teaching practices and maximize their impact on student learning.

In interviews with the KESSHA chair, the HOI and the DHOI, a DHOI emphasized,

"Having sufficient laboratory equipment makes our Biology lessons more dynamic and captivating for students. It goes beyond textbooks, allowing them to experience science hands-on."

This sentiment resonates with the Likert Scale Question 1 results, where 67% of respondents agreed on the positive impact of laboratory resources on student performance. Moreover, a KESSHA chair passionately expressed,

"A well-equipped classroom creates an environment where students feel motivated to explore and learn."

This echoes the sentiments in Likert Scale Question 3, where 67% of respondents recognized the significant influence of classroom facilities on student learning outcomes. These qualitative insights underscore the inter-connectedness of teaching and learning resources, showcasing the educators' awareness of the multifaceted factors shaping student performance in Biology. The convergence of interview responses with the quantitative findings reinforces the need for comprehensive strategies to address resource challenges and promote equitable access, fostering an environment conducive to optimal learning outcomes.

From the analysis, the majority of respondents recognized the positive impact of laboratory equipment and materials on student performance, highlighting the importance of hands-on experiences in scientific learning. However, challenges were noted in resource allocation, particularly in textbooks and other learning materials, emphasizing the need for equitable access to quality resources. Additionally, the significance of classroom facilities, technological resources, and supplementary teaching aids in enhancing student engagement and comprehension was acknowledged, though access and utilization challenges persist. The qualitative interviews further reinforced these findings, indicating educators' awareness of the inter-connectedness of resources and their impact on student outcomes, calling for comprehensive strategies to address resource challenges and promote optimal learning environments.

Influence of Availability and Utilization of the Library on the Students' Performance in Biology

In the analysis conducted to assess how the availability and utilization of the library influence the performance of biology in students in day secondary schools in Kuresoi South Sub County, Nakuru County, Likert scale questions were employed to gather insights from teachers regarding various aspects of library resources. The results are presented in figure 4.3.

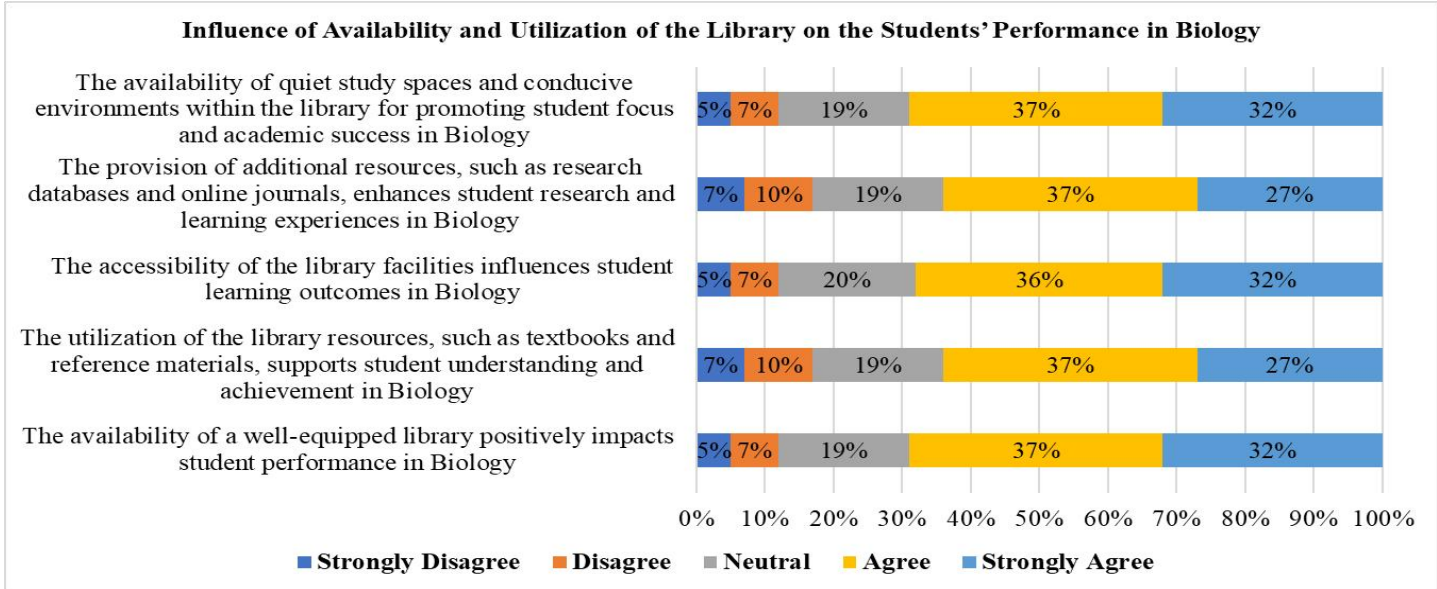


Figure 4. 3: Influence of Availability and Utilization of the Library on the Students' Performance in Biology

In Likert Scale Question 1, "To what extent do you agree that the availability of a well-equipped library positively impacts student performance in Biology?" which evaluated the impact of the availability of a well-equipped library on student performance in Biology, 65% of respondents either agreed or strongly agreed that a well-equipped library positively impacted student performance. This finding was consistent with existing literature emphasizing the importance of libraries in promoting academic achievement (Hornby, 2010; Wikipedia, 2010). However, it was notable that 22% of respondents expressed neutral sentiments, suggesting potential variations in perceptions of the library's impact on student performance.

Likert Scale Question 2 "How effectively do you believe the utilization of the library resources, such as textbooks and reference materials, supports student understanding and achievement in Biology?" which focused on the effectiveness of library resource utilization in supporting student understanding and achievement in Biology. While 69% of respondents rated library resource utilization as effective or somewhat effective, 13% expressed neutral or negative sentiments. These findings underscored the importance of maximizing the utilization of library resources to enhance student learning outcomes, consistent with literature highlighting the positive correlation between library usage and academic achievement (Lonsdale, 2003; EHow, 2011).

Likert Scale Question 3, "To what degree do you perceive that the accessibility of the library facilities influences student learning outcomes in Biology?" which examined the perceived influence of library facilities' accessibility on student learning outcomes in Biology. The majority of respondents (68%) indicated that the accessibility of library facilities significantly influenced student learning outcomes. This aligned with literature emphasizing the importance of accessible library facilities in fostering conducive learning environments and promoting student focus and academic success (George, 2011; Busayo, 2011). Likert Scale Question 4 "How adequately do you feel the provision of additional resources, such as research databases and online journals, enhances student research and learning experiences in Biology?" which assessed the adequacy of additional resources, such as research databases and online journals, in enhancing student research and learning experiences in Biology. A majority of respondents (64%) rated the provision of additional resources as moderately to extremely adequate. This finding highlighted the importance of supplementing traditional library resources with digital resources to cater to diverse learning needs and promote comprehensive research skills development (Ashioya, 2012).

Lastly, Likert Scale Question 5, "In your opinion, how crucial is the availability of quiet study spaces and conducive environments within the library for promoting student focus and academic success in Biology?" which evaluated the importance of quiet study spaces and conducive environments within the library for promoting student focus and academic success in Biology. 69% of respondents rated the availability of quiet study spaces and conducive environments as important

to extremely important. This underscored the significance of creating conducive study environments within the library to facilitate effective learning experiences and academic success (Karimi, 2011; Gettinger and Siebert, 2002).

Overall, the findings suggested that the availability and utilization of the library play a crucial role in influencing student performance in Biology. However, there is a need for continuous efforts to enhance resource accessibility, optimize resource utilization, and create conducive study environments to maximize the library's potential in promoting academic success.

Interviews with the KESSHA chairs, the HOI and the DHOI revealed insightful perspectives that complemented the Likert scale responses. One HOI remarked,

"Our library is a hub for exploration and discovery. Students who engage with its resources tend to have a deeper understanding of Biology concepts."

This sentiment resonated with the findings in Likert Scale Question 2, where 69% of respondents emphasized the effectiveness of library resource utilization in supporting student achievement. Furthermore, KESSHA chairs passionately expressed,

"Quiet study spaces are like sanctuaries for focused learning. Students need that environment to delve into complex topics like Biology."

This sentiment resonated strongly with the importance attributed to quiet study spaces in Likert Scale Question 5, where 69% of respondents emphasized their crucial role in promoting student focus and academic success. These qualitative insights provide a nuanced understanding of the multifaceted role of the library in shaping student performance in Biology, reinforcing the importance of resource accessibility, utilization, and conducive study environments to maximize its impact on academic success.

From the analysis, the majority of respondents recognized the positive impact of a well-equipped library on student performance, aligning with literature emphasizing the role of libraries in academic achievement. However, neutral sentiments from some respondents suggest varying perceptions regarding the library's impact. Effective utilization of library resources was highlighted as crucial, emphasizing the need to maximize resource usage for enhanced learning outcomes. Additionally, the accessibility of library facilities and the provision of additional resources were deemed important factors influencing student learning outcomes, underscoring the importance of resource accessibility and diversity. The qualitative interviews further emphasized the role of libraries as hubs for exploration and focused learning environments, highlighting the need for conducive study spaces. Overall, continuous efforts are needed to enhance resource accessibility, utilization, and create conducive study environments to maximize the library's potential in promoting academic success in Biology.

Influence of Availability and Equipping of Biology Laboratory on Students' Performance in Biology

In the analysis conducted to examine how the availability and equipping of biology laboratories influence the performance of biology in students in day secondary schools in Kuresoi South Sub County, Nakuru County, Likert scale questions were utilized to gather insights from teachers regarding various aspects of laboratory resources. The results are presented in figure 4.4.

In Likert Scale Question 1, "To what extent do you agree that the availability of well-equipped biology laboratories positively impacts student performance in Biology?" which assessed the impact of the availability of well-equipped biology laboratories on student performance in Biology, 65% of respondents either agreed or strongly agreed that well-equipped biology laboratories positively impact student performance. This finding was consistent with existing literature emphasizing the crucial role of laboratories in science education and their positive influence on academic achievement (Akeayir et al., 2016; Tekalign, 2016). However, it was concerning that 20% of respondents expressed neutral sentiments, indicating potential variations in perceptions of the laboratory's impact on student performance.

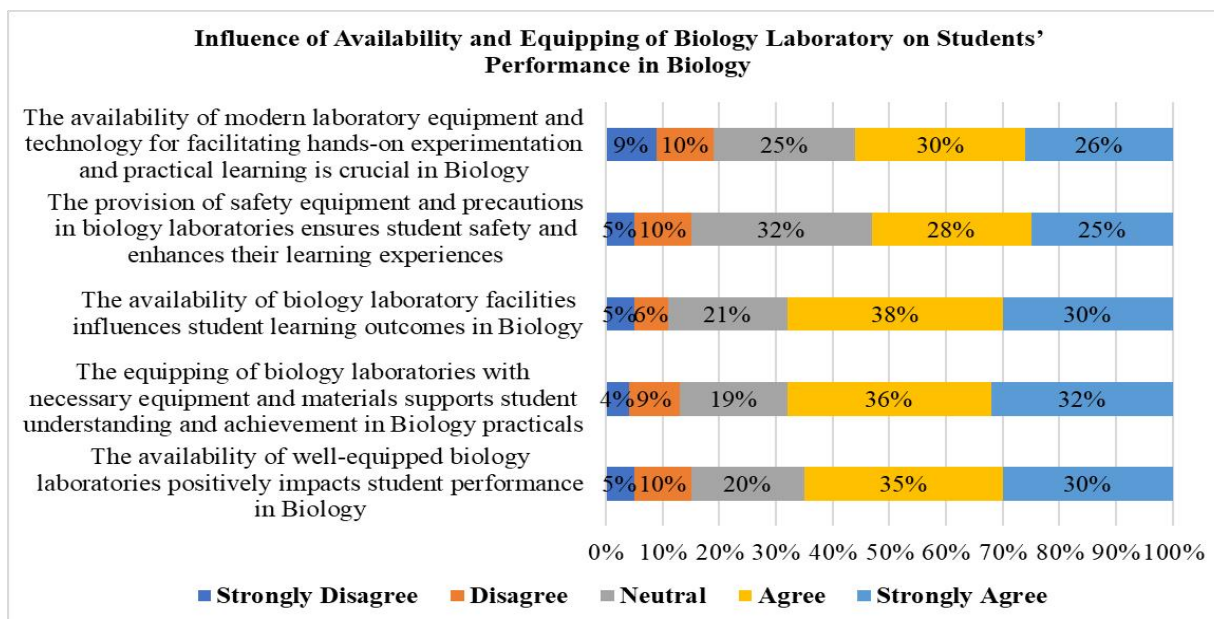


Figure 4. 4: Influence of Availability and Equipping of Biology Laboratory on Students' Performance in Biology

Likert Scale Question 2, "How effectively do you believe the equipping of biology laboratories with necessary equipment and materials supports student understanding and achievement in Biology practicals?" which focused on the effectiveness of equipping biology laboratories with necessary equipment and materials in supporting student understanding and achievement in Biology practicals. While 68% of respondents rated the equipping of biology laboratories as effective or somewhat effective, 13% expressed neutral or negative sentiments. These findings underscored the importance of ensuring that biology laboratories are adequately equipped to facilitate practical learning experiences, consistent with literature highlighting the positive correlation between laboratory resources and academic outcomes (Ademola & Adebola, 2011; Iheanyi et al., 2014).

Likert Scale Question 3, "To what degree do you perceive that the availability of biology laboratory facilities influences student learning outcomes in Biology?" which examined the perceived influence of biology laboratory facilities' availability on student learning outcomes in Biology. The majority of respondents (68%) indicated that the availability of biology laboratory facilities significantly influenced student learning outcomes. This aligned with literature emphasizing the importance of accessible and well-equipped laboratory facilities in fostering practical skill development and enhancing academic performance (Zenda, 2016; Okomolate & Adesua, 2016).

Likert Scale Question 4, "How adequately do you feel the provision of safety equipment and precautions in biology laboratories ensures student safety and enhances their learning experiences?" which assessed the adequacy of safety equipment and precautions in biology laboratories to ensure student safety and enhance their learning experiences. A majority of respondents (60%) rated the provision of safety equipment and precautions as moderately to extremely adequate. This underscored the importance of prioritizing student safety in laboratory environments and providing adequate safety measures to facilitate effective practical learning experiences (Saeed & Wain, 2011; Okafor, 2000).

Lastly, Likert Scale Question 5, "In your opinion, how crucial is the availability of modern laboratory equipment and technology for facilitating hands-on experimentation and practical learning in Biology?" which evaluated the importance of the availability of modern laboratory equipment and technology for facilitating hands-on experimentation and practical learning in Biology. 56% of respondents rated the availability of modern laboratory equipment and technology as important to extremely important. This highlighted the significance of integrating modern laboratory equipment and technology into biology instruction to enhance practical learning experiences and promote student engagement (Mwangi, 2016; Alimi et al., 2012).

Overall, the findings suggested that the availability and equipping of biology laboratories play a crucial role in influencing the performance of biology in students. However, there is a need for continuous efforts to ensure that biology

laboratories are adequately equipped, safe, and conducive to practical learning experiences to maximize their potential in promoting academic success.

In interviews, a DHOI eloquently stated,

"A well-equipped biology lab is like a canvas for scientific exploration. Students gain confidence and a deeper understanding of Biology when they can actively engage with practical experiments."

This sentiment resonated with the 65% agreement observed in Likert Scale Question 1, emphasizing the positive impact of well-equipped biology laboratories on student performance. Another HOI expressed,

"Equipping the lab with the right tools is essential for hands-on learning. It's not just about having the resources but ensuring they align with the curriculum and enhance students' practical skills."

This perspective echoed the sentiments captured in Likert Scale Question 2, where 68% of respondents emphasized the effectiveness of equipping biology laboratories with necessary equipment and materials. These qualitative perspectives enriched the analysis by emphasizing the holistic role of well-equipped and adequately equipped biology laboratories in fostering practical skill development, aligning with the need for continuous efforts to optimize their potential in promoting academic success.

From the analysis, the majority of respondents recognized the positive impact of well-equipped biology laboratories on student performance, aligning with existing literature emphasizing the crucial role of laboratories in science education. However, neutral sentiments from some respondents indicate varying perceptions regarding the laboratory's impact. Effective equipping of biology laboratories with necessary equipment and materials was highlighted as crucial for supporting practical learning experiences and enhancing academic outcomes. The availability of biology laboratory facilities was also deemed significant in influencing student learning outcomes, underscoring the importance of accessible and well-equipped facilities. Additionally, ensuring student safety through adequate provision of safety equipment and precautions was emphasized. The qualitative interviews further emphasized the transformative role of well-equipped and adequately equipped biology laboratories in fostering practical skill development and deeper understanding of Biology concepts. Overall, continuous efforts are needed to optimize the potential of biology laboratories in promoting academic success through adequate equipping, safety measures, and conducive practical learning environments.

Conclusion and way forward:

Influence of Availability and Adequacy of Human Resources on the Performance of Biology by Students in Kuresoi South Sub County, Nakuru County:

In conclusion, the analysis of the availability and adequacy of human resources in day secondary schools in Kuresoi South Sub County sheds light on various factors influencing student performance in Biology. The majority agreement regarding the positive impact of qualified Biology teachers underscores the importance of teacher qualifications in enhancing academic outcomes. However, concerns regarding resource allocation effectiveness and support from school administration highlight potential areas for improvement in resource management and leadership within schools. Additionally, the perceived importance of professional development opportunities and supplementary teaching aids suggests the need for ongoing investment in teacher training and resource provision to optimize student learning experiences. Overall, addressing these challenges and leveraging available resources effectively can contribute to improved student performance in Biology.

Influence of Availability and Adequacy of Teaching and Learning Resources on the Students' Performance in Biology:

In summary, the analysis of teaching and learning resources availability and adequacy in day secondary schools in Kuresoi South Sub County offers valuable insights into their influence on student performance in Biology. The findings underscore the critical role of well-equipped biology laboratories, textbooks, and supplementary teaching aids in facilitating student understanding and engagement in Biology lessons. However, concerns regarding resource accessibility and effectiveness highlight the need for continuous efforts to address resource disparities and optimize resource utilization. Additionally, the perceived influence of classroom facilities and technological resources on student learning outcomes underscores the

importance of creating conducive learning environments and integrating technology into instruction. Overall, prioritizing resource provision and enhancing resource utilization can contribute to improved student performance in Biology.

Influence of Availability and Utilization of the Library on the Students' Performance in Biology:

In conclusion, the analysis of library availability and utilization in day secondary schools in Kuresoi South Sub County provides valuable insights into their impact on student performance in Biology. The majority agreement regarding the positive influence of well-equipped libraries and effective library resource utilization underscores the importance of libraries in promoting academic achievement. However, concerns regarding resource accessibility and the adequacy of additional resources highlight the need for ongoing investment in library infrastructure and digital resources. Additionally, the perceived importance of quiet study spaces and conducive environments underscores the significance of creating conducive learning environments within libraries. Overall, addressing these challenges and optimizing library resources can contribute to improved student performance in Biology.

Influence of Availability and Equipping of Biology Laboratory on Students' Performance in Biology:

In summary, the analysis of biology laboratory availability and equipping in day secondary schools in Kuresoi South Sub County provides valuable insights into their influence on student performance in Biology. The findings highlight the critical role of well-equipped biology laboratories and necessary equipment in supporting student understanding and achievement in Biology practicals. However, concerns regarding resource adequacy and safety measures underscore the need for continuous efforts to ensure laboratory safety and resource optimization. Additionally, the perceived importance of modern laboratory equipment and technology emphasizes the significance of integrating technological advancements into biology instruction. Overall, addressing these challenges and optimizing laboratory resources can contribute to improved student performance in Biology.

References

- Adewale, A.M & Nzewuihe, G. & Ogunshola, F. (2016). *Academic Performance in Biology at Secondary School Certificate Examination (SSCE) and the Influencing Factors among Students in Owerri Municipal of Imo State, Nigeria*. Retrieved from www.iiardpub.org IIARD on 31 March 2020 at 1400hours
- Akubuilu, D. U (2004). *The Effect of Problem-solving Instructional Strategies on Student's Achievement and Retention in Biology with respect to location in Enugu State*. Journal of the Science Teachers Association of Nigeria, 24(1&2), 94-100
- Araoye, M.I (2014). *Redressing Students' Motivation and Academic Achievement in Biology Education at the Federal College of Education (Special) Oyo State, Nigeria*.
- Arokoyu, A.A et al (2017). *Biology Teachers Methods of Teaching and Academic Performance of Secondary School Students in Abia State, Nigeria*.
- Best, J.W. et al. (2006). *Education Research* (10th Ed.) Upper Saddle River, NJ:Pearson Education, Inc.
- Adalikwu, S. A., & Iorkpilgh, I. T. (2013). The influence of instructional materials on academic performance of senior secondary school students in chemistry in Cross River State. *Global Journal of Educational Research*, 12(1), 39-46.
- Akungu, J. A. (2014). Influence of teaching and learning resources on students' performance in Kenya certificate of secondary education in free day secondary education in Embakasi district, Kenya (Doctoral dissertation, University of Nairobi).
- Suresh, M., Vishnu Priya, V., & Gayathri, R. (2018). Effect of e-learning on academic performance of undergraduate students. *Drug Invention Today*, 10(9), 1-12.
- Roscigno, V. J., & Ainsworth-Darnell, J. W. (1999). Race, cultural capital, and educational resources: Persistent inequalities and achievement returns. *Sociology of education*, 158-178.

- Bizimana, B & Orodho, J.A (2014). *Teaching and Learning resource availability and teacher's Effective classroom management and Content Delivery in secondary school in Huye District, Rwanda*. Retrieved from www.iiste.org on 31 March 2020.
- Bulsjeta, R. (2013). *Effective use of Teaching and Learning Resources*. Czech- Polish.
- CEMASTEA, (2019). *Training Module for Secondary School Teachers on Learner Centered Strategies and competency Based Curriculum*, CEMASTE: Nairobi.
- Creswell, J.W et al. (2011). *Designing and Conducting Mixed Methods Research*. (2nd Ed): Sage Publications, Inc Thousand Oaks
- Luvega, D. et al (2019). *Kenya: Congestion in High Schools as 100% Transition Policy Takes Effect*. *Daily Nation*, 12 January 2019, Accessed from <https://allafrica.com/stories/201901140069.html> 7 April 2020.
- Dhurumraj, T. (2013). *Contributory Factors to Poor Learner performance in Physical Sciences in Kwazulu-Natal Province with Special reference to Schools in the Pinetown District*. Master's Thesis, University of South Africa.
- Gardner, R (1985). *Social Psychology and Second Language Learning*. London: Edward Arnold
- Higgs, P & Smith, J (2008). *Rethinking truth*. 2nd edition, Juta, Cape Town.
- Kaitho, S. N (2018). *Effect of Teaching using Preferred Learning Styles on Students' Performance in Biology and Geography in Secondary Schools in Nairobi County, Kenya*. Kabarak University. PHD Thesis.
- Kenya National Examinations Council. (1992). *KCSE National examination results, 2013*. Nairobi: Kenya National Examinations Council.
- Kihwele, J. E (2014). *Students' Perception of Science Subjects and their Attitude in Tanzanian Secondary Schools*. Mzumbe University.
- Koskei. B.K (2012). *Influence of Socio-Economic Background on Academic Performance of Public Mixed Day Secondary School Students in Kuresoi District*. M. Phil thesis, Moi University, Eldoret.
- Koskei, B.K (2014). *Influence of parental involvement on Student's Academic Performance of Public Mixed Day Secondary Schools in Kuresoi Sub County, Nakuru*. Moi University, Kenya.
- Kothari, C. R (1985). *Research Methodology: Methods and Techniques*. Wiley Eastern Limited, New Delhi.
- Nyongesa, K.W (2015). *A Teachers Perspective on the Challenges in the Delivery of Content and Performance in Biology: A Case of Bungoma District, Kenya*. Kabarak University, Kenya.
- Ong'amo, B.L et al (2017). *Extent of use of Biology instructional resources and effect on students' academic performance in secondary schools in Siaya County – Kenya*. Nairobi: Unpublished MA Thesis.
- Oduol, J.J (2016). *Factors Contributing to Poor Performance of Science Subjects: A Case Study of Secondary Schools in Busia County*. PGDE Project. University of Nairobi.
- Olufemi, O.T et al (2018). *Factors Affecting Students' Academic Performance in Colleges of Education in Southwest, Nigeria*. *British Journal of Education* Vol.6, No.10, pp.43-56, Retrieved from www.eajournals.org on 31st March 2020.
- Osborne, J (2003). *Attitudes towards Science: A review of the literature and its implication*. King's College London.
- Owino, O.A et al *An investigation of Factors that Influence Performance in KCSE Biology in Selected Secondary Schools in Nyakach District, Kisumu County, Kenya*.
- Ozturk, E (2003). *An Assessment of High School Biology Curriculum Implementation*. Middle East Technical University. PHD Thesis.
- Samikwo, D.C (2013). *Factors which influence academic performance in Biology in Kenya: A perspective for global competitiveness*.
- Wafula, N. F et al (2017). *Effects of Sequential Teaching Methods on Retention of Knowledge in Biology by Secondary School Students in Kenya*.
- Wanzala, O (2017). *Teachers point out pitfalls in free school's plan*. Retrieved from <https://nation.africa/kenya/news/teachers-point-out-pitfalls-in-free>

Obomanu, B.J (2011). *Resources for Teaching Secondary School Biology in Bayelsa State of Nigeria*. University of Port Harcourt. Information and Knowledge Management, 1(2), 1-10.

Saro, J.M (2022). *Ethno-Learning Resources in Teaching Biology*. Agusan. Philippines.

Olu-Ajayi, F. E (2017). *Effects of Mentoring in the Utilization and Improvisation of Biology Learning Resources on the Performance of Senior Secondary School Students in South West Nigeria*. European Scientific Journal, 13(4), Retrieved on 21st March 2023, <http://dx.doi.org/10.19044/esj.2017.v13n4p270>

Shikalepo, E.E. (2020). *Defining a Conceptual Framework in Educational Research*. Namibia University. Windhoek.

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