INFLUENCE OF SCHOOL-BASED CURRICULUM IMPLEMENTATION DYNAMICS ON MATHEMATICS PERFORMANCE IN KCSE IN PUBLIC SECONDARY SCHOOLS IN KITUI RURAL SUB-COUNTY KITUI COUNTY, KENYA

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DEDICATION

This research is dedicated to my spouse, children, and supportive colleagues who provided unwavering encouragement throughout my study period.

DECLARATION AND APPROVAL

Declaration

This project is my original work and has never been presented for any academic award in any institution.

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ABSTRACT

Mathematics education is pivotal for equipping students with essential analytical and problem-solving skills necessary for socio-economic advancement. Despite extensive government initiatives and reforms in Kenya, mathematics performance in public secondary schools remains subpar, especially in rural areas like Kitui Rural Sub-County. Over the past five years, more than 73% of students have consistently scored D+ or below in the Kenya Certificate of Secondary Education (KCSE) mathematics examinations. This persistent underachievement poses a significant barrier to educational equity and future opportunities, making it imperative to examine the underlying factors influencing performance. This study explored how school-based curriculum implementation dynamics—namely instructional strategies, instructional materials, classroom environment, and instructional leadership practices—affect mathematics performance in public secondary schools in Kitui Rural Sub-County. Guided by Constructivist Learning Theory, which underscores the importance of active student engagement in knowledge construction, and Instructional Leadership Theory, which highlights the role of school leadership in fostering effective teaching practices, the research employed a mixed-methods design. Data were collected from a representative sample of 379 students, 260 mathematics teachers, and 132 school leaders using structured questionnaires and in-depth interviews. Quantitative data were analyzed through descriptive and inferential statistics, while thematic analysis was employed for qualitative data, enriching the contextual understanding of the research problem. Findings revealed that interactive instructional strategies, such as peer teaching, group activities, and formative assessments, significantly enhanced student engagement and comprehension, thereby improving mathematics outcomes. The availability and quality of instructional materials, including textbooks, visual aids, and digital resources, also emerged as crucial determinants of effective curriculum delivery. Furthermore, the classroom environment—encompassing both physical (e.g., cleanliness, seating arrangement) and psychosocial (e.g., student-teacher interactions, classroom discipline) elements—was found to be integral in fostering a conducive atmosphere for learning. Notably, instructional leadership practices, including professional development for teachers, regular classroom supervision, and resource allocation, were identified as pivotal in supporting innovative instructional strategies and sustaining improved mathematics performance. While these findings affirm the interconnected nature of curriculum implementation dynamics, challenges such as inadequate resources, overcrowded classrooms, and limited professional development opportunities for teachers continue to constrain progress. These factors underscore the urgent need for targeted interventions that address the specific realities of rural schools in Kenya. The study recommends prioritizing active learning approaches, ensuring equitable distribution of instructional materials, improving physical and psychosocial classroom conditions, and fostering strong instructional leadership practices. Equipping school leaders with the skills to mentor and support teachers, alongside ensuring access to updated teaching resources, will be critical in bridging the performance gap. In conclusion, this research offers valuable insights into the multifaceted dynamics shaping mathematics performance in Kitui Rural Sub-County. By integrating the perspectives of both teachers and students and anchoring the analysis in robust theoretical frameworks, the study contributes to a nuanced understanding of curriculum implementation challenges in rural Kenya. The findings inform policymakers, educators, and stakeholders on the importance of context-sensitive strategies to create equitable, effective learning environments, ultimately fostering improved mathematics outcomes and broader educational equity in Kenya.

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LIST OF ABBREVIATIONS AND ACRONYMS

KCSE	Kenya Certificate of Secondary Education
KEMI	Kenya Education Management Institute
MKU	Mount Kenya University
MOEST	Ministry of Education Science and Technology
SPSS	Statistical Packages for Social Scientists
UAE	United Arab Emirates

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter presents the following sections: Introduction, Background to the Study, Statement of the Problem, Purpose of the Study, Objectives of the Study, Research Questions, Justification of the Study, Significance of the Study, Scope of the Study, Limitation of the Study, Delimitations of the Study, Assumptions of the Study, and Operational Definition of Key Terms.

1.1 Background to the Study

Mathematics education is universally acknowledged as a cornerstone of modern knowledge economies, fostering critical thinking, logical reasoning, and problem-solving skills that are essential for personal development and national progress. Globally, educational reforms have prioritized effective instructional strategies and leadership practices to address persistent gaps in mathematics achievement. For example, the OECD (2021) underscores that active learning techniques and formative assessments, when combined with adequate instructional materials, significantly improve mathematics outcomes. Furthermore, the World Bank (2020) highlights that student engagement and teacher professional development play a critical role in transforming mathematics learning experiences. Nevertheless, despite these well-documented benefits, UNESCO (2022) reports that over 60% of students worldwide continue to fall below minimum proficiency levels in mathematics, highlighting a persistent gap between policy aspirations and classroom realities. Critically, these global trends reveal that while instructional strategies and resources are foundational, they must be integrated and supported by robust instructional leadership to create holistic learning environments that promote student success (Mullis et al., 2020).

Global efforts have increasingly emphasized the importance of aligning instructional practices with available resources and ensuring that teachers receive consistent support through professional

development and mentorship. For instance, in Finland, the integration of ICT tools and hands-on learning approaches has contributed to a 15% increase in mathematics performance in secondary schools (Ahtola et al., 2019). In contrast, studies in the United States show that disparities in resource allocation, particularly in low-income districts, continue to hamper mathematics performance despite national initiatives to promote equity (Darling-Hammond, 2017; Johnson & Johnson, 2017). This underscores the complexity of translating global frameworks into practical solutions that address both instructional and contextual realities. The challenge lies in integrating instructional strategies, resources, classroom environments, and leadership practices into a cohesive whole—a theme that this study seeks to explore in the local context of Kitui County.

In the African context, the struggle to improve mathematics performance in secondary schools remains a significant concern. Many African countries face chronic shortages of instructional materials, under-resourced classrooms, and teachers who lack continuous professional development opportunities (UNICEF, 2020). These issues are compounded by overcrowded classrooms and socio-economic disparities that create uneven learning opportunities for students (African Union, 2021). Research by Spaull (2019) in South Africa found that mathematics scores improved by 18% when students had access to well-equipped classrooms, highlighting the interplay between physical resources and instructional quality. Similarly, Olaniyan and Okemakinde (2018) in Nigeria demonstrated that schools investing in differentiated instructional practices—tailored to student needs—achieved significantly higher performance in mathematics, underscoring the importance of context-specific solutions.

Efforts to address these challenges have increasingly focused on building teacher capacity through targeted professional development programs. In Ghana, for example, the consistent use of formative assessments has been shown to improve mathematics performance by 20%, but only in schools with robust leadership support and access to updated teaching resources (Amoako, 2020). Yet, these successes remain uneven across the continent, with rural schools in particular facing the

dual challenge of limited resources and inconsistent instructional supervision (World Bank, 2019). This demonstrates that while effective teaching strategies are essential, their impact is contingent on the broader learning environment and the leadership structures that support them—a crucial insight for this study.

In East Africa, governments have increasingly recognized the need for student-centered pedagogies to boost mathematics outcomes. Countries like Uganda and Tanzania have prioritized inquiry-based learning and problem-solving activities to foster deeper understanding and engagement (East African Community, 2020). Nakabugo et al. (2019) report that incorporating collaborative learning approaches in Ugandan secondary schools led to a 12% improvement in mathematics scores, particularly when paired with formative assessments. However, resource disparities between urban and rural schools remain a persistent barrier, as many rural classrooms continue to face shortages of textbooks, teaching aids, and basic infrastructure (UNESCO, 2021).

Instructional leadership in East Africa is also evolving, with school administrators increasingly tasked with supporting teachers through classroom supervision and professional development. In Tanzania, Mosha (2018) found that regular teacher evaluations and resource management by instructional leaders contributed to a 10% increase in mathematics performance. Nevertheless, many rural schools still struggle to access leadership training and mentorship opportunities, limiting the potential impact of these practices (Makwinya & HakiElimu, 2020). These regional trends highlight that while strategies and resources are critical, they must be integrated within a supportive leadership framework to create environments that nurture mathematics learning.

In Kenya, the Ministry of Education has consistently emphasized the importance of enhancing instructional strategies and leadership practices to improve KCSE mathematics performance (Ministry of Education, 2021). Recent national data reveals significant disparities in student outcomes, with rural schools consistently underperforming compared to their urban counterparts

(Kenya National Bureau of Statistics, 2022). Studies by Mwangi and Njagi (2019) indicate that implementing continuous assessments and active learning techniques has led to a 15% improvement in mathematics scores in urban schools, yet these gains have been uneven in rural areas. This suggests that while national policies advocate for best practices, the implementation gap remains substantial, especially in resource-constrained settings.

Additionally, infrastructural challenges in rural Kenya further complicate mathematics performance. Wanjiru (2020) found that students in overcrowded classrooms with inadequate ventilation scored 22% lower in KCSE mathematics compared to peers in well-equipped learning environments. While policies exist to enhance instructional supervision and improve classroom conditions, studies such as Ndirangu (2021) reveal that implementation has been inconsistent, with many rural schools receiving minimal support from educational authorities. This underscores the critical need to understand how instructional strategies, leadership practices, and classroom environments intersect to influence mathematics performance—an area that has received limited empirical attention in rural Kenyan contexts.

In Kitui County, the context of this study, mathematics performance has persistently lagged behind national averages, with over 73% of students scoring a D+ or below in KCSE mathematics in recent years (Kitui County Education Office, 2022). This underperformance is closely linked to challenges such as overcrowded classrooms, inadequate teaching resources, and limited professional development opportunities for teachers (Mutua, 2022). While interventions like peer teaching and contextual learning have been piloted in some schools, their implementation has been uneven, often hindered by resource constraints and insufficient instructional leadership support (Nzioka, 2020). These challenges are compounded by the socio-economic realities of Kitui Rural Sub-County, where many students come from low-income households, further limiting access to essential learning materials (Kitui County Government, 2021).

Kitui County also presents a unique research opportunity, as it remains under-researched despite its consistent struggle with poor mathematics outcomes. Previous studies have focused primarily on broad national or urban-rural disparities, overlooking the specific local dynamics in areas like Kitui Rural Sub-County. This study seeks to fill this gap by critically examining how school-based curriculum implementation dynamics—including instructional strategies, instructional materials, classroom environments, and instructional leadership—interact to shape mathematics performance in this rural context. By providing context-specific insights, the study aims to inform targeted interventions and contribute to more equitable educational outcomes in Kenya.

1.2 Statement of the Problem

Mathematics performance in Kenyan public secondary schools consistently falls short of national expectations, jeopardizing the promise of quality and equitable education for all. Ideally, students are expected to demonstrate competence in mathematical reasoning, problem-solving, and analytical thinking, which are critical for success in further studies and the workforce. However, in Kitui Rural Sub-County, the reality is starkly different, with over 73% of students scoring a D+ or below in mathematics over the past five years (Kitui County Education Office, 2022). This persistent gap not only reflects a failure to meet national benchmarks but also limits students' opportunities for higher education and future employment.

While the Kenyan government has introduced various initiatives—including in-service teacher training, provision of digital learning resources, and reforms emphasizing student-centered teaching—these efforts have not yielded significant improvements in mathematics outcomes in rural areas like Kitui (Ministry of Education, 2021). The limited impact of these interventions highlights deeper issues of implementation that remain unaddressed. In many rural schools, overcrowded classrooms, inadequate instructional materials, and minimal support for teachers continue to hamper effective learning. These challenges suggest a need to examine how local curriculum practices,

including instructional strategies, leadership, and classroom environments, collectively influence mathematics performance in such contexts.

The consequences of continued underperformance are profound, affecting not only individual learners but also their families and communities. Poor mathematics outcomes contribute to higher dropout rates, diminished access to tertiary education, and a constrained pipeline of skilled professionals critical for national development (World Bank, 2021). Moreover, existing studies have largely overlooked the unique interplay of these challenges in rural settings, focusing instead on urban or peri-urban areas. This study addresses this research gap by exploring how school-based curriculum implementation dynamics shape mathematics performance in Kitui Rural Sub-County. It seeks to generate context-specific insights and practical recommendations that can inform more effective, locally grounded interventions for rural schools in Kenya.

1.3 Purpose of the Study

The purpose of this study was to examine the influence of School-based curriculum implementation dynamics on mathematics performance in the KCSE in public secondary schools in Kitui Rural Sub-County, Kitui County, Kenya.

1.4 Objectives of the Study

The specific objectives guiding this study were: -

i. To investigate how instructional leadership practices shape the adoption of effective instructional strategies on mathematics performance in KCSE in public secondary schools in Kitui Rural Sub-County, Kitui County.

ii. To analyze the influence of instructional strategies on mathematics performance in KCSE in public secondary schools in Kitui Rural Sub-County, Kitui County.

iii. To assess the impact of instructional materials on the effectiveness of instructional strategies and mathematics performance in KCSE in public secondary schools in Kitui Rural Sub-County, Kitui County.

iv. To examine the influence of the classroom environment on mathematics performance in KCSE in public secondary schools in Kitui Rural Sub-County, Kitui County.

1.5 Research questions

i. How does instructional leadership practices shape the adoption of effective instructional strategies on mathematics performance in KCSE in public secondary schools in Kitui Rural Sub-County, Kitui County.

ii. What is the influence of instructional strategies on mathematics performance in KCSE in public secondary schools in Kitui Rural Sub-County, Kitui County.

iii. What is the impact of instructional materials on the effectiveness of instructional strategies and mathematics performance in KCSE in public secondary schools in Kitui Rural Sub-County, Kitui County.

iv. What is the influence of the classroom environment on mathematics performance in KCSE in public secondary schools in Kitui Rural Sub-County, Kitui County?

1.6 Hypothesis of the Study

Based on the objectives of the study, the following hypotheses guided the research:

1. **H_0**: Instructional leadership practices have no significant influence on mathematics performance in KCSE.

H_1: Instructional leadership practices significantly influence mathematics performance in KCSE.

2. **H_0**: Instructional strategies have no significant influence on mathematics performance in KCSE.

   H_1: Instructional strategies significantly influence mathematics performance in KCSE.

3. **H_0**: Instructional materials have no significant influence on mathematics performance in KCSE.

   H_1: Instructional materials significantly influence mathematics performance in KCSE.

4. **H_0**: The classroom environment has no significant influence on mathematics performance in KCSE.

   H_1: The classroom environment significantly influences mathematics performance in KCSE.

1.6 Justification of the Study

This study is justified by the need to address the persistent poor performance in mathematics in public secondary schools within Kitui County. Despite various interventions and resource allocations by the government, the desired improvement in student performance has not been achieved. Understanding the specific curriculum implementation dynamics that affect mathematics performance was crucial for developing effective interventions (Ministry of Education, 2019).

Additionally, this study provides valuable insights into the broader context of curriculum implementation in Kenya, contributing to national educational strategies and policies. By identifying the key factors hindering effective curriculum implementation, the study helps in designing targeted policies and programs to improve mathematics performance.

The findings are particularly relevant for policymakers, educators, and stakeholders in the education sector. The study's focus on Kitui Rural Sub-County offers a detailed case study that can serve as a reference for other regions facing similar challenges (World Bank, 2021). This regional focus allows

for context-specific recommendations that can inform broader educational reforms and interventions.

1.7 Significance of the Study

The significance of this study lies in its potential to inform and influence educational practices and policies at both local and national levels. By providing a detailed analysis of the factors affecting curriculum implementation and their impact on mathematics performance, the study offers practical recommendations for improving student outcomes. The Ministry of Education can use these findings to prioritize resource allocation and training programs, ensuring that schools in the greatest need receive the necessary support to enhance mathematics performance.

Additionally, this study contributes to the existing body of literature on curriculum implementation and student performance, offering new insights and perspectives for future researchers and educators. The results are beneficial to teachers by highlighting effective strategies for curriculum delivery and identifying areas where further support and professional development are needed.

Ultimately, this research fosters a more conducive learning environment that helps students achieve their full potential in mathematics. The findings serve as a foundation for targeted interventions and informed decision-making, promoting educational equity and improved performance in public secondary schools, particularly in regions like Kitui Rural Sub-County.

1.8 Scope of the Study

This study focused on public secondary schools in Kitui Rural Sub-County, Kitui County, Kenya, examining how School-based curriculum implementation dynamics influence mathematics performance in the KCSE exams. The research covered the period from 2018 to 2023 and analyzed trends and factors affecting student outcomes. A representative sample of schools within the sub-county was selected, and data were collected from both teachers and students through structured

questionnaires and interviews. This approach provided a comprehensive understanding of instructional practices, resources, teacher competencies, and school environments.

The scope was justified as it offered a focused analysis of localized educational challenges, enabling the study to produce targeted recommendations applicable to schools in the region. The chosen timeframe captured recent educational reforms, allowing the study to assess their impact on mathematics outcomes. By involving diverse perspectives from both teachers and students, the study produced reliable findings to support evidence-based interventions aimed at enhancing mathematics performance in Kitui Rural Sub-County.

1.9 Limitation of the Study

The geographical dispersion of schools in Kitui Rural Sub-County presented significant logistical challenges during data collection. Schools were located across vast distances with limited transport infrastructure, making in-person visits time-consuming and financially demanding. These logistical constraints risked delays in data collection and, at times, limited the depth of investigation in particularly remote schools. To address this, the study implemented a sampling strategy that ensured balanced representation across wards while optimizing travel routes to reduce time and costs. Additionally, data collection schedules were carefully planned to align with school activities, minimizing disruptions and improving overall efficiency.

Another notable limitation was the accessibility and condition of some remote schools, which posed challenges for conducting structured interviews and administering surveys. In certain cases, poor road networks and infrastructural constraints hindered the researcher's ability to access all target schools as planned. To mitigate these challenges, digital surveys and remote interviews were employed where feasible, enabling data collection even when physical visits were not possible. This approach ensured that all respondents, regardless of location, could participate, thus enriching the dataset and maintaining the study's representativeness and reliability.

The willingness and availability of respondents also emerged as a limitation, with some teachers and students constrained by busy academic schedules. Concerns about confidentiality and potential repercussions occasionally affected the candor of some responses, potentially introducing response bias. To counter this, the researcher emphasized the voluntary nature of participation and provided assurances of confidentiality. These efforts, coupled with clear communication of the study's academic purpose, fostered trust and encouraged more open and authentic responses from participants.

Additionally, external factors beyond the immediate focus of the study, such as socio-economic status, cultural influences, and home environments, may not have been fully captured within the study's scope. These factors are known to influence student performance but were not the primary focus of this research. To address this, the study included targeted questions to gather contextual information on respondents' backgrounds, enabling a more nuanced interpretation of the findings. While not exhaustive, these measures provided a broader understanding of the factors at play and enriched the study's overall analysis.

1.10 Delimitations of the Study

This study was intentionally limited to public secondary schools in Kitui Rural Sub-County, Kitui County, Kenya, to ensure a focused and manageable research scope. The decision to exclude private schools was made to maintain consistency in educational environments, funding structures, and policy implementation, as public schools often face similar challenges in curriculum implementation and resource availability. By narrowing the focus to public institutions, the study was better positioned to explore the unique dynamics of curriculum practices that directly impact mathematics performance in this rural setting.

The research also examined data from 2018 to 2023, capturing recent trends and policy interventions that have shaped the educational landscape in Kitui Rural Sub-County. Teachers and students were selected as primary respondents to provide firsthand insights into the realities of curriculum

implementation and classroom practices. These choices ensured that the study's findings were both relevant and actionable, offering specific recommendations for improving mathematics outcomes in rural public schools. By clearly defining the study's boundaries, the research maintained focus and depth, enabling a thorough analysis of curriculum implementation dynamics in this local context.

1.11 Assumptions of the Study

This study was grounded on several assumptions critical to ensuring the reliability and validity of its findings. It was assumed that students' mathematics performance was primarily shaped by school-based curriculum implementation dynamics, including the availability of instructional materials, teacher competencies, and the overall classroom environment. It was further assumed that teachers and students were knowledgeable about these dynamics and capable of providing accurate and honest responses about their impact on performance. All respondents were expected to participate willingly and share unbiased information, supported by the confidentiality of the research process. Finally, it was assumed that the data collection instruments, such as questionnaires and interviews, were effective in capturing the information needed to address the research objectives comprehensively. These assumptions formed the foundation for robust data collection and analysis, guiding the study's insights and conclusions.

1.12 Operational Definition of Key Terms

Curriculum Implementation Dynamics: In this study, curriculum implementation dynamics refer to the interconnected factors shaping how the mathematics curriculum is delivered in public secondary schools. This construct was measured using structured questionnaires and interviews that explored instructional strategies (e.g., use of active learning), availability and utilization of instructional materials, classroom management practices, and the effectiveness of instructional leadership. Responses were collected through Likert-scale items and open-ended questions that provided both quantitative and qualitative insights into these processes.

Mathematics Performance: in this study was operationalized through the students' mean scores in mathematics as reported in their Kenya Certificate of Secondary Education (KCSE) results from 2018 to 2022. Additional performance indicators were obtained from continuous assessment records, as self-reported by students and validated through school records where possible. This dual approach ensured a comprehensive measure of students' mathematical proficiency.

Public Secondary Schools: These are government-funded secondary education institutions in Kitui Rural Sub-County, as identified in the official Ministry of Education database. Schools selected for the study were verified as public and fully operational during the research period, ensuring consistency in the institutional context evaluated.

KCSE (Kenya Certificate of Secondary Education): The national examination that serves as the final assessment of student achievement at the end of secondary schooling in Kenya. In this study, KCSE mathematics scores for

2018–2023 were the primary data points used to assess student mathematics performance in each participating school.

Teacher Competency: In the context of this study, teacher competency was measured through multiple indicators, including years of teaching experience, professional qualifications, frequency of participation in professional development programs, and self-reported teaching methodologies. Data was collected through structured questionnaires and confirmed via school records where available, providing a comprehensive view of teacher capacity.

School Environment: The physical and psychosocial conditions of the classroom and school setting as reported and observed in this study. Physical conditions included classroom space, lighting, ventilation, and cleanliness, measured through observation checklists and teacher reports. Psychosocial conditions encompassed student-teacher interactions, classroom discipline, and peer relationships, evaluated through student and teacher questionnaire responses.

Instructional Materials: For this study, instructional materials were measured by assessing the types of resources available (textbooks, visual aids, digital tools) and their perceived adequacy and relevance to the curriculum. Data were gathered through questionnaires to teachers and students, supplemented by physical observations of available materials in sampled schools. The operational definition focused on the alignment of these materials with the mathematics curriculum and their frequency of use in lesson delivery.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter provides a comprehensive review of existing literature related to the influence of School-based curriculum implementation dynamics on mathematics performance in public secondary schools. It encompasses an empirical literature review, offering insights into previous research findings and their relevance to the current study. Additionally, the chapter presents the theoretical framework that underpinned this research, drawing on established theories to explain the relationships between the study variables. Finally, a conceptual framework is developed to visually represent these relationships and guide the investigation. Through this literature review, the study built a solid foundation for understanding the factors impacting mathematics performance and identified gaps that the research aimed to address.

2.2 Empirical Literature Review

2.2.1 Influence of Instructional Leadership Practices on Mathematics Performance in KCSE in Public Secondary Schools

Instructional leadership plays a significant role in shaping educational outcomes, particularly in mathematics, by supporting teachers through professional development, classroom supervision, and resource management. Effective instructional leaders—principals, department heads, and school administrators—ensure that teachers receive continuous support, adequate resources, and supervision to foster an optimal learning environment. The quality and frequency of teacher development programs, classroom observations, and targeted resource allocation significantly influence mathematics performance.

Globally, instructional leadership is recognized as a critical driver of student achievement, particularly in mathematics, by supporting teachers through professional development, classroom

supervision, and targeted resource management. In the United States, Leithwood and Jantzi (2019) reported a 10% improvement in mathematics scores in schools where principals engaged in regular classroom observations and provided structured feedback, fostering a culture of instructional excellence. Similarly, Hallinger (2020) found that in Australia, increasing the frequency of professional development sessions for mathematics teachers led to a 15% rise in standardized mathematics test scores, underscoring the transformative role of ongoing teacher support. Ahtola et al. (2019) in Finland further observed that schools with robust resource allocation strategies saw a 20% improvement in mathematics proficiency, highlighting the importance of providing teachers with adequate teaching materials and tools. Collectively, these studies emphasize that instructional leadership, when operationalized through continuous support and resource management, significantly enhances student performance in mathematics.

In addition to supporting teacher development, effective instructional leadership is linked to improved student engagement and learning environments. Mullis et al. (2020) reported that globally, schools where instructional leaders actively facilitated teacher collaboration and peer learning reported an 18% improvement in mathematics outcomes. This collaborative approach not only elevated teacher competencies but also fostered a more inclusive and dynamic classroom environment. However, these successes are not without challenges; Darling-Hammond et al. (2020) cautioned that in low-income districts in the United States, disparities in access to leadership training and resources continued to hinder sustained improvements, underscoring the need for equitable resource allocation and support systems.

At the continental level, instructional leadership in Africa has been shown to significantly influence student mathematics performance, although contextual challenges persist. In Nigeria, Ogunyinka and Adedoyin (2019) documented a 30% increase in student performance in schools where mathematics teachers participated in frequent professional development programs, highlighting the pivotal role of continuous teacher support. Conversely, these initiatives were found to be heavily

concentrated in urban areas, leaving rural schools under-resourced and underserved. Bush and Glover (2019) in South Africa reported a 12% increase in mathematics scores in schools where leaders conducted regular classroom supervision with constructive feedback, reinforcing the need for a culture of accountability and support. In Ghana, Ampofo et al. (2020) found that targeted resource allocation for mathematics, including updated textbooks and digital tools, led to a 15% improvement in scores, although delays in government funding often undermined these efforts.

Despite these advances, limitations in leadership capacity and funding remain prevalent in many African contexts. Spaull (2019) noted that while professional development initiatives in sub-Saharan Africa have shown promise, only 40% of rural schools consistently implemented these programs, leading to persistent gaps in mathematics outcomes. Similarly, Mugo and Wanjohi (2021) found that schools with supportive instructional leadership were twice as likely to report improvements in mathematics performance compared to those without such structures, suggesting that leadership practices remain a crucial determinant of educational equity across the continent.

In East Africa, instructional leadership is gaining recognition as an essential lever for improving mathematics education. Nakabugo et al. (2019) in Uganda found that professional development sessions for mathematics teachers resulted in a 14% improvement in student test scores, particularly when paired with mentorship and collaborative teaching strategies. However, these programs often struggled with inconsistent funding and logistical challenges in rural areas. Mosha (2018) in Tanzania reported a 10% improvement in mathematics outcomes where instructional leaders engaged in systematic classroom supervision and offered targeted feedback, helping teachers refine their instructional techniques. Similarly, Makwinya and HakiElimu (2020) observed a 17% improvement in Tanzanian schools that prioritized resource allocation for mathematics instruction, underscoring the need for leadership practices that ensure equitable access to learning materials.

Across East Africa, studies emphasize that the impact of instructional leadership extends beyond individual classrooms, fostering a school-wide culture of continuous improvement. Nsubuga (2021) in Uganda highlighted that schools with strong instructional leadership practices reported higher levels of teacher collaboration and student engagement, which translated into a 15% improvement in mathematics scores. Nevertheless, the challenge of sustaining these gains in resource-constrained rural environments remains a pressing concern for policymakers and educators alike.

In Kenya, instructional leadership has been identified as a central factor in addressing disparities in mathematics performance, particularly in public secondary schools. Mwangi and Njagi (2019) found that quarterly professional development workshops for mathematics teachers led to a 20% increase in student scores, with teachers reporting greater confidence in using active learning and formative assessment techniques. However, these opportunities were often less accessible to teachers in rural regions. Wanjiru (2020) documented a 15% improvement in schools where heads of departments conducted regular classroom observations, emphasizing the value of constructive feedback in enhancing instructional practices. Ndirangu (2021) further noted that schools allocating over 30% of their budget to mathematics-related resources saw a 22% rise in student performance, highlighting the critical role of resource prioritization in effective instructional leadership.

Despite these positive trends, challenges remain in scaling and sustaining effective leadership practices in Kenya's rural schools. Kimani and Njeru (2022) reported that while professional development initiatives are increasingly available, only 35% of rural schools consistently participate in these programs, limiting their impact on mathematics outcomes. This underscores the importance of ensuring that instructional leadership practices are not only initiated but also institutionalized and adapted to the unique needs of rural contexts.

In Kitui County, instructional leadership practices have begun to show promising results, although inconsistencies persist. Mutua (2022) found that schools conducting regular teacher training

workshops recorded a 12% improvement in KCSE mathematics scores, as teachers gained practical strategies for addressing curriculum gaps. However, funding limitations and competing priorities hindered the frequency of these workshops. Nzioka (2020) reported that schools where principals conducted monthly classroom supervision saw a 10% increase in mathematics performance, as teachers received timely and actionable feedback. Additionally, the Kitui County Education Office (2022) documented a 15% improvement in mathematics outcomes in schools that allocated additional resources specifically for mathematics instruction, including digital tools and supplementary learning materials.

Despite these improvements, challenges unique to Kitui Rural Sub-County, such as limited access to leadership training and resource disparities, continue to limit the full realization of these gains. Musyoka (2021) noted that only 40% of schools in Kitui Rural Sub-County regularly implemented professional development initiatives, and only 30% engaged in structured classroom supervision practices, reflecting persistent gaps in leadership practices. These findings highlight the need for targeted interventions that strengthen instructional leadership in rural schools, ensuring consistent support for teachers and fostering more equitable student outcomes in mathematics.

Empirical evidence underscores the importance of instructional leadership in enhancing mathematics performance. Practices such as frequent professional development sessions, regular classroom supervision, and strategic resource allocation have been shown to improve mathematics outcomes significantly. Globally, countries like Finland and Australia have achieved notable success by ensuring consistent teacher training and adequate resource management. In Africa, while professional development and supervision practices show promise, limited resources and inconsistent funding hinder their full potential. In Kenya, and specifically Kitui County, emerging instructional leadership practices are gradually improving mathematics performance. However, ensuring sustained professional development opportunities, consistent classroom supervision, and timely resource allocation will be crucial to fostering long-term improvement in students'

mathematics outcomes. This study builds on these insights to explore how instructional leadership can further enhance mathematics education in Kitui Rural Sub-County.

2.2.2 Influence of Instructional Strategies on Mathematics Performance in KCSE in Public Secondary Schools

The use of appropriate instructional strategies plays a critical role in improving student outcomes, especially in subjects like mathematics, where comprehension and problem-solving skills are essential. Effective strategies such as active student engagement, the use of formative assessments, and employing diverse instructional methods ensure learners interact meaningfully with mathematical concepts. Instructional strategies have evolved globally, from teacher-centered approaches to more interactive, learner-centered methods aimed at fostering deep learning.

Globally, instructional strategies have evolved significantly, moving from traditional teacher-centered methods to dynamic, learner-focused approaches aimed at fostering critical thinking and problem-solving skills in mathematics. Hattie (2019) in Australia demonstrated that schools prioritizing active student engagement, such as student-led discussions and interactive tasks, reported a 15% increase in mathematics test scores. This participatory learning environment helped students internalize complex mathematical concepts. In the United States, Johnson and Johnson (2019) found that cooperative learning approaches led to a 20% improvement in mathematics performance compared to lecture-based methods, highlighting the importance of peer interaction and collaborative problem-solving. These findings emphasize that when students are actively involved in the learning process, they develop deeper understanding and improved retention of mathematical principles.

Formative assessments also play a crucial role in driving mathematics achievement. Sahlberg (2020) reported that students in Finland who regularly received feedback through formative assessments achieved 25% higher mathematics scores than those who did not. This continuous feedback loop

allowed teachers to adjust their instructional strategies to address learning gaps. In Singapore, Tan and Goh (2021) observed a 20% increase in mathematics performance when teachers incorporated formative assessment practices, enabling students to track their progress and refine their problem-solving skills. These global studies highlight that instructional strategies combining active engagement and continuous feedback mechanisms are instrumental in enhancing mathematics outcomes.

Across Africa, instructional strategies that promote active engagement and diverse teaching methods are increasingly recognized for their potential to boost mathematics performance. In Nigeria, Olaniyan and Okemakinde (2019) found a 30% improvement in mathematics scores among students exposed to inquiry-based learning compared to those taught through rote memorization. However, the study highlighted resource limitations as a barrier to the broader adoption of these practices. Spaull (2019) in South Africa documented an 18% improvement in mathematics scores when teachers employed interactive tools such as visual aids and manipulatives, underscoring the importance of contextualizing learning through practical examples. Despite these gains, the challenges of inadequate teaching resources and large class sizes continue to affect the effectiveness of such strategies.

Formative assessments have also emerged as key drivers of student success in African schools. Amoako (2020) in Ghana reported a 20% improvement in mathematics performance in schools that consistently used quizzes and feedback sessions to monitor student progress. This practice empowered students to understand their weaknesses and work collaboratively with teachers to improve their learning outcomes. However, the study noted that teachers needed further professional development to design and deliver formative assessments effectively. These findings indicate that while innovative strategies hold promise, their successful implementation depends on equipping teachers with the necessary skills and resources.

In East Africa, recent studies demonstrate that incorporating varied instructional strategies significantly improves mathematics outcomes. Nakabugo et al. (2020) in Uganda reported a 12% increase in mathematics scores among students engaged in problem-solving activities and student-led discussions. These interactive strategies encouraged learners to connect mathematical concepts to real-life contexts, fostering a more meaningful understanding. In Tanzania, Makwinya and HakiElimu (2020) found that differentiated instruction tailored to students' abilities resulted in a 15% improvement in mathematics performance. This approach ensured that all students, regardless of their learning pace, could grasp essential concepts. Nevertheless, these strategies' sustainability requires ongoing support and resource allocation, which remains a challenge in many rural schools.

Technology-based instructional strategies have also gained traction in the region. In Rwanda, Gatsinzi et al. (2019) observed a 10% improvement in mathematics scores in schools using ICT-based instructional methods. Digital tools and interactive software made learning more engaging and allowed students to visualize abstract mathematical ideas. However, the study emphasized that teacher training and reliable technology infrastructure are critical to maximizing these strategies' benefits. Collectively, these East African studies highlight that while diverse instructional strategies enhance mathematics performance, consistent teacher training and equitable resource distribution are vital for their success.

In Kenya, evidence shows that interactive instructional strategies are directly linked to improved KCSE mathematics outcomes. Wanjiru (2020) reported a 22% improvement in mathematics scores in schools where teachers incorporated student group activities, fostering peer-to-peer learning and critical dialogue. Mwangi and Njagi (2019) similarly found that continuous assessments with structured feedback improved mathematics performance by 15%, as students became more aware of their progress and could address specific learning gaps. These studies emphasize the transformative role of structured feedback and collaborative learning in promoting student-centered approaches.

Guided discovery learning has also shown promising results in Kenyan schools. Ndirangu (2021) found an 18% increase in mathematics scores in classrooms that embraced guided discovery, where students actively explored mathematical concepts with minimal direct instruction. However, the study noted that for guided discovery to be effective, teachers required specialized training and smaller class sizes to provide tailored support. These findings underscore the importance of equipping teachers with the necessary skills and resources to implement innovative strategies effectively, particularly in rural contexts.

Within Kitui County, efforts to integrate active instructional strategies into mathematics education have yielded encouraging results. Mutua (2022) reported a 10% improvement in KCSE mathematics scores in schools using peer teaching approaches, where higher-performing students supported their peers through collaborative activities. This fostered a sense of shared responsibility and enriched the learning process. However, the study cautioned that the effectiveness of peer teaching depended heavily on consistent teacher supervision and guidance to maintain academic rigor.

Nzioka (2020) highlighted the benefits of contextual learning in Kitui County, noting a 12% increase in mathematics scores when teachers connected mathematical concepts to local experiences such as farming and small business practices. Contextual learning made abstract ideas more relatable, enhancing student engagement and motivation. The Kitui County Education Office (2022) also reported a 15% improvement in mathematics outcomes in schools that implemented formative assessments, enabling teachers to identify struggling students early and tailor interventions to their needs. Nonetheless, these gains were often constrained by resource limitations, such as insufficient teaching materials and large class sizes.

Empirical evidence highlights the importance of instructional strategies, such as active student engagement, formative assessments, and diverse teaching methods, in improving mathematics performance. Globally, approaches like inquiry-based learning, cooperative teaching, and

continuous feedback mechanisms have driven significant improvements in student outcomes. In Africa and East Africa, efforts to adopt interactive strategies are showing positive results, although challenges such as limited resources and teacher capacity persist. In Kenya, and particularly in Kitui County, promising results from peer teaching, contextual learning, and formative assessments demonstrate the potential for improved mathematics performance. However, the sustainability of these strategies depends on continuous professional development for teachers and adequate resource allocation. This study builds on these insights to explore how instructional strategies can be further optimized to enhance mathematics performance in Kitui Rural Sub-County.

2.2.3 Influence of Instructional Materials on Mathematics Performance in KCSE in Public Secondary Schools

Instructional materials play a pivotal role in shaping student performance, particularly in subjects that require a strong foundation, such as mathematics. The availability and quality of instructional materials significantly impact students' ability to grasp complex mathematics concepts and perform in examinations. This section delves into empirical studies that explore the influence of instructional materials on mathematics performance.

Globally, high-quality instructional materials have been shown to play a pivotal role in improving student performance in mathematics, particularly in standardized assessments. In Australia, Goss and Sonnemann (2020) reported a 17% increase in mathematics scores in schools that effectively integrated digital learning resources alongside traditional textbooks. These materials provided students with diverse ways to engage with abstract mathematical concepts, enhancing comprehension and application. In Finland, Ahtola et al. (2019) found that students with access to updated mathematics textbooks scored 15% higher in standardized mathematics tests compared to their peers who relied on outdated resources. This finding underscores the importance of aligning instructional materials with current curricula to ensure relevance and depth in learning.

Despite global recognition of their importance, disparities in access to quality instructional materials persist. Darling-Hammond et al. (2019) in the United States found that schools with well-stocked libraries and digital learning tools saw a 20% improvement in mathematics performance compared to under-resourced schools. However, Johnson and Johnson (2020) observed that rural schools in low-income districts had a 25% deficit in essential materials due to funding inequities, limiting the impact of these instructional resources on student learning. These disparities highlight the need for equitable investment in instructional materials as a foundation for mathematics success.

In Africa, challenges in providing and maintaining quality instructional materials remain a significant barrier to educational equity. Olaniyan and Okemakinde (2019) in Nigeria found that schools with adequate instructional resources achieved 25% higher mathematics scores than those lacking essential materials. However, the study highlighted that rural schools often faced challenges in securing up-to-date textbooks and teaching aids due to limited government funding. Spaull (2019) in South Africa reported a 30% difference in mathematics performance between well-resourced and under-resourced schools, emphasizing the stark disparities across different communities.

Efforts to address these challenges have been met with mixed results across the continent. Amoako (2020) in Ghana found that logistical challenges in textbook distribution led to a 20% deficit in rural schools, although community-driven resource-sharing initiatives helped bridge some of these gaps. The Ghana Learning Program, for instance, achieved a 12% improvement in mathematics performance by providing targeted instructional materials to underserved communities (Amoako, 2020). These findings suggest that while instructional materials have a clear impact, their effectiveness depends on the systems in place to distribute and utilize them equitably.

In East Africa, the provision and effective use of instructional materials have emerged as priorities in educational reforms aimed at improving mathematics outcomes. Nakabugo et al. (2019) in Uganda found that schools with access to adequate instructional materials achieved 18% higher

mathematics scores than those without. Similarly, Makwinya and HakiElimu (2020) in Tanzania observed a 15% improvement in student performance in schools where teachers consistently used updated textbooks and visual aids to supplement lessons. These findings indicate that both the availability and the actual use of materials in lesson delivery are crucial to enhancing mathematics learning.

Despite these gains, regional disparities remain pronounced. The East African Community (EAC, 2021) reported that rural schools across the region faced a 30% shortage of essential instructional materials compared to urban schools, limiting the effectiveness of even the most skilled teachers. In response, regional collaborations and partnerships, such as the MasterCard Foundation's Scholars Program, have invested in providing high-quality learning materials, leading to notable improvements in student performance in partner schools (MasterCard Foundation, 2021).

In Kenya, the link between instructional materials and mathematics performance has been widely acknowledged in policy and practice. Wanjiru (2020) found that access to updated mathematics textbooks resulted in a 20% increase in KCSE mathematics scores, underscoring the direct impact of high-quality resources on student outcomes. Mwangi and Njagi (2019) similarly observed a 15% improvement in performance in schools where teachers used a variety of teaching aids, such as manipulatives and visual models, to illustrate mathematical concepts. These studies highlight that both traditional and innovative resources play a role in supporting mathematics learning.

However, disparities between urban and rural schools in Kenya remain a persistent challenge. The Ministry of Education (2021) reported a 30% lower availability of essential mathematics textbooks in rural public schools compared to urban ones, directly affecting performance outcomes. This inequity is compounded by infrastructural challenges that limit the use of digital learning tools in remote areas, further disadvantaging rural students.

Within Kitui County, the availability and use of instructional materials have emerged as key determinants of mathematics performance. The Kitui County Education Office (2022) reported a 25% shortage of essential mathematics textbooks in public secondary schools, particularly in rural areas. However, targeted interventions have shown promise. Mutua (2021) found that providing supplementary teaching aids and workbooks led to a 12% improvement in KCSE mathematics scores, as students engaged more actively with problem-solving exercises. Nzioka (2020) similarly observed a 15% increase in mathematics performance in schools that partnered with community organizations to provide additional instructional materials, including locally adapted learning resources.

Despite these positive developments, challenges persist in ensuring equitable access to instructional materials across Kitui's rural schools. Limited funding and logistical barriers often delay the distribution of essential resources, constraining teachers' ability to implement interactive and student-centered learning approaches. Mutuku (2021) reported that only 40% of public secondary schools in Kitui County consistently used updated mathematics textbooks and teaching aids, reflecting gaps that continue to hinder performance.

The empirical literature review highlights the critical role of instructional materials in enhancing mathematics performance among students. From a global to a local perspective, studies consistently show that the availability and quality of instructional materials significantly impact student outcomes. Addressing the challenges in resource provision through innovative solutions and targeted interventions is essential for improving mathematics performance in public secondary schools. This study builds on these insights to explore the specific dynamics in Kitui Rural sub-County, Kitui County, and propose strategies to enhance the availability and quality of instructional materials.

2.2.4 Influence of the Classroom Environment on Mathematics Performance in KCSE in Public Secondary Schools

The classroom environment plays a vital role in shaping student learning experiences and academic performance, particularly in mathematics. A conducive environment, encompassing physical, psychosocial, and atmospheric aspects, fosters student engagement, comprehension, and achievement. A well-maintained physical environment provides the necessary infrastructure, while a supportive psychosocial environment ensures positive teacher-student relationships and effective discipline. Additionally, a motivating learning climate nurtures participation and academic curiosity, which are essential for subjects like mathematics.

Globally, the classroom environment has been recognized as a critical factor in shaping students' academic performance, particularly in mathematics, where engagement and sustained concentration are essential. In the United States, Earthman (2019) found that students learning in well-lit, ventilated classrooms scored 12% higher in mathematics than those in suboptimal environments. Similarly, Tanner (2020) in Canada reported a 15% increase in mathematics test scores in classrooms with comfortable furniture and modern infrastructure. These findings suggest that physical elements of the classroom environment contribute to improved focus and better understanding of mathematical concepts.

Beyond physical aspects, the psychosocial environment also plays a pivotal role in academic outcomes. Hattie (2021) in Australia reported that positive teacher-student relationships contributed to a 17% increase in mathematics performance. Classrooms that fostered trust, mutual respect, and regular feedback provided students with the confidence to engage in complex problem-solving. In Japan, Fujimoto et al. (2019) demonstrated that group-based learning approaches, which encouraged peer interaction and support, led to a 10% improvement in mathematics performance. This underscores that classrooms designed to nurture collaboration and interpersonal connections are essential for fostering mathematical proficiency.

In Africa, the classroom environment remains a crucial determinant of student achievement, particularly in resource-constrained settings. Adeyemi (2019) in Nigeria found that well-ventilated classrooms with adequate space resulted in a 20% increase in mathematics scores. However, many rural schools continue to grapple with overcrowding and limited infrastructure, which hinders effective teaching and learning. In Ghana, Amoako (2020) reported a 15% improvement in mathematics performance in classrooms with stable seating arrangements and minimal distractions, highlighting the importance of orderly physical environments for student focus.

The psychosocial dimension of classroom environments in Africa also significantly influences performance. Spaull (2019) in South Africa found that positive peer relationships and collaborative learning environments contributed to a 12% improvement in mathematics performance. The study noted that students in classrooms where teachers fostered open dialogue and constructive feedback were more willing to tackle challenging mathematical problems. In Uganda, Ngugi (2019) observed that supportive teacher behaviors, including individualized attention and clear explanations, led to a 14% increase in mathematics achievement.

Regionally, East African studies further highlight the importance of both physical and psychosocial environments in mathematics outcomes. Mosha (2018) in Tanzania found that schools with well-maintained classrooms achieved an 18% increase in mathematics scores, emphasizing the role of infrastructure in facilitating effective learning. Nakabugo et al. (2019) in Uganda reported a 12% improvement in mathematics performance in classrooms with strict discipline and orderly conduct, which allowed students to concentrate and engage more deeply in lessons. Gatsinzi et al. (2019) in Rwanda found that students who received continuous feedback and motivation from teachers achieved a 15% increase in mathematics scores, underscoring the importance of supportive and encouraging environments.

Despite these findings, disparities in classroom environments between urban and rural schools in East Africa persist. MasterCard Foundation (2021) observed that rural classrooms often lacked the basic infrastructure and psychosocial support needed for optimal learning, resulting in lower mathematics outcomes compared to urban schools. This highlights the need for sustained investment and policy focus on creating equitable learning environments across different regions.

In Kenya, the influence of the classroom environment on mathematics performance has been well documented. Wanjiru (2020) found that students in classrooms with adequate space and clean, well-maintained facilities achieved 22% higher mathematics scores in KCSE. However, rural schools often faced challenges with overcrowding and poor infrastructure, limiting the potential benefits of even the best teaching practices. Mwangi and Njagi (2019) reported that positive psychosocial environments, including supportive teacher-student relationships and collaborative learning practices, led to an 18% improvement in mathematics scores. These findings underscore that fostering a safe, inclusive, and interactive environment is essential for mathematics success.

Furthermore, Ndirangu (2021) emphasized the role of a motivating learning climate, showing that consistent feedback and positive reinforcement improved mathematics performance by 20%. However, the study noted that in rural areas, such practices were often hindered by resource constraints and large class sizes, which limited teachers' ability to provide individualized attention and create engaging classroom dynamics.

In Kitui County, empirical evidence reveals that both physical and psychosocial aspects of classroom environments significantly impact mathematics performance. Mutua (2022) found that schools with well-maintained classrooms and adequate learning materials recorded a 10% improvement in KCSE mathematics scores. However, the study also noted that many schools faced challenges in maintaining infrastructure due to limited funding. The Kitui County Education Office (2022) reported a 12% increase in mathematics performance in classrooms that had proper

ventilation and seating arrangements, highlighting the importance of basic physical conditions for student concentration and success.

The psychosocial environment in Kitui County schools has also been linked to better mathematics outcomes. Nzioka (2020) found that supportive teacher-student relationships and a collaborative classroom culture contributed to a 15% improvement in mathematics scores. Teachers who created a positive learning climate—characterized by continuous feedback, motivation, and a sense of belonging—helped students overcome anxieties associated with learning mathematics. Mutuku (2021) reported that when teachers reinforced positive behaviors and provided individualized support, mathematics performance improved by 13%, further underscoring the impact of a nurturing psychosocial environment.

Empirical evidence consistently demonstrates the significant influence of the classroom environment on mathematics performance. Physical elements, such as adequate space, ventilation, and infrastructure, play a critical role in creating conducive learning spaces. Psychosocial aspects, including positive teacher-student relationships and collaborative peer interactions, further enhance engagement and academic outcomes. A motivating learning climate, characterized by continuous feedback and reinforcement, fosters student participation and persistence, particularly in challenging subjects like mathematics. In Kitui County, addressing resource constraints and promoting supportive classroom environments are essential steps toward improving mathematics performance in KCSE. This study builds on these insights to explore specific environmental dynamics within Kitui Rural Sub-County, offering actionable recommendations for enhancing mathematics outcomes.

2.3 Theoretical Framework

The theoretical framework for this study integrated Constructivist Learning Theory and Instructional Leadership Theory to explore the multiple factors influencing mathematics

performance in KCSE within public secondary schools in Kitui Rural Sub-County, Kitui County. This framework provided a comprehensive lens for analyzing instructional strategies, instructional materials, classroom environments, and instructional leadership practices, focusing on how they shaped students' learning experiences and outcomes.

Constructivist Learning Theory highlights the importance of active student engagement and experiential learning, emphasizing how instructional strategies impact performance (Piaget, 1954; Vygotsky, 1978). This theory asserts that students learn best when they actively construct knowledge through hands-on activities, discussions, and real-world problem-solving. Instructional Leadership Theory underscores the role of school leaders in aligning instructional practices, facilitating professional development, and managing resources to achieve educational goals (Hallinger & Heck, 1998). Effective instructional leadership ensures that teachers receive the necessary support, supervision, and materials to enhance instructional quality and improve student outcomes. Together, these theories provided an integrative framework for analyzing the factors impacting mathematics outcomes and developing evidence-based recommendations for enhancing student performance in Kitui Rural Sub-County.

2.3.1 Constructivist Learning Theory

Constructivist Learning Theory, developed by Piaget (1954) and expanded by Vygotsky (1978), posits that learners actively construct their own knowledge through meaningful experiences, social interaction, and reflection. This theory guided the study's investigation into instructional strategies and their influence on mathematics performance. Constructivist teaching emphasizes engaging students in hands-on activities, problem-solving tasks, and collaborative learning, fostering deeper understanding and retention of mathematical concepts. Instructional strategies such as inquiry-based learning, peer teaching, and cooperative group activities align with this theory by actively involving students in the learning process and promoting critical thinking (Yager & Yager, 2019).

In this study, Constructivist Learning Theory provided insights into how teaching practices shaped students' mathematical understanding and outcomes. Specifically, it guided the evaluation of strategies employed by teachers in Kitui Rural Sub-County, such as interactive group work, practical applications, and formative assessments. These methods enhanced student engagement and performance by creating meaningful connections between abstract mathematical concepts and real-world experiences. Constructivism also supported the design of teacher professional development programs that equipped educators with effective strategies to foster active learning. Informed by this theory, the study assessed how the use of learner-centered approaches influenced student participation and mathematical achievement in the KCSE.

2.3.2 Instructional Leadership Theory

Instructional Leadership Theory focuses on the pivotal role of school leaders in shaping teaching and learning outcomes through strategic oversight, resource allocation, and professional development (Hallinger & Heck, 1998). Effective instructional leadership involves setting academic goals, fostering teacher collaboration, and providing continuous feedback to enhance instructional practices (Robinson, Lloyd, & Rowe, 2018). In the context of this study, Instructional Leadership Theory underpinned the analysis of leadership practices and their influence on mathematics performance.

In Kitui Rural Sub-County, school leaders played a critical role in managing instructional resources, ensuring teacher preparedness, and creating environments conducive to student learning. This theory guided the evaluation of how principals and heads of departments implemented professional development initiatives, allocated teaching resources, and monitored instructional practices to improve mathematics outcomes. The study explored specific leadership practices, such as regular teacher supervision, goal-setting exercises, and data-driven decision-making, to assess their impact on mathematics achievement. Instructional Leadership Theory highlighted the importance of leadership in creating a shared vision for academic success and aligning school resources to achieve

measurable improvements in student performance (Hallinger, 2011). By examining these leadership practices, the study provided insights into how effective instructional leadership can contribute to better mathematics performance in KCSE.

2.4 Conceptual Framework

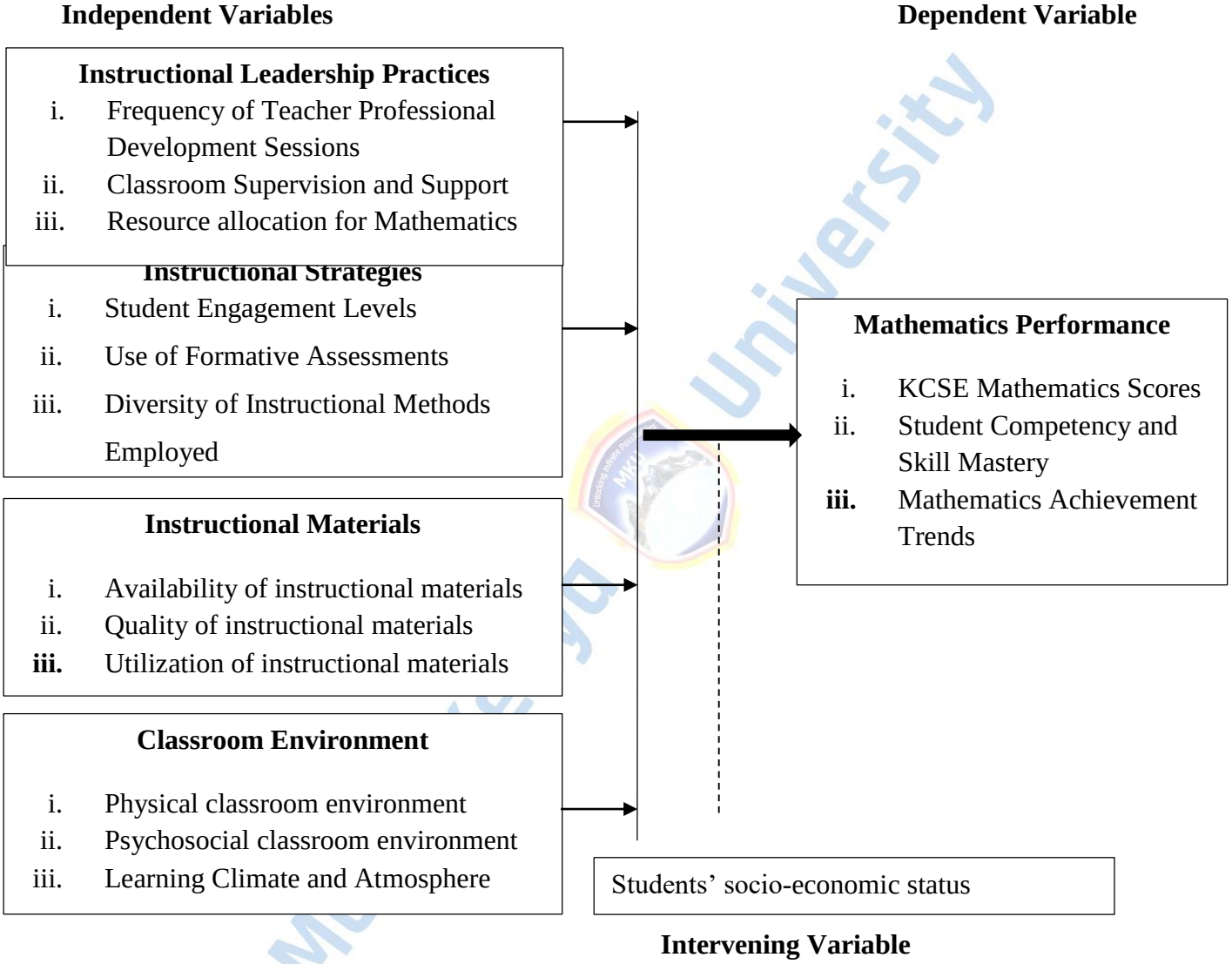

Figure 2. 1: Conceptual Framework

Source: Researcher (2024)

The conceptual framework of this study provided a structured approach to understanding how various curriculum implementation dynamics influenced mathematics performance in public secondary schools. The key independent variables were identified as instructional strategies, instructional materials, classroom environment, and instructional leadership practices, each

contributing to students' academic success in different ways. These variables played a distinct role in shaping how well students grasped mathematical concepts and performed in the Kenya Certificate of Secondary Education (KCSE) examinations. Additionally, the framework recognized the moderating role of students' socio-economic status (SES), as factors such as family income, parental education, and access to learning resources significantly impacted how effectively students benefited from the curriculum.

Instructional Strategies focused on how teachers engaged students in learning, provided feedback through formative assessments, and applied diverse teaching methods to enhance understanding. Instructional Materials emphasized the importance of providing sufficient resources, such as textbooks and digital tools, ensuring they were aligned with the curriculum and effectively utilized in lessons.

The Classroom Environment considered both physical aspects (such as space, ventilation, and infrastructure) and psychosocial elements (such as positive relationships between students and teachers, effective classroom management, and a motivating learning atmosphere). These factors worked together to create conditions conducive to learning, helping students develop problem-solving skills and conceptual understanding. Instructional Leadership Practices played a critical role in supporting teachers and ensuring the effective implementation of instructional strategies. School leaders were responsible for providing professional development opportunities, offering instructional supervision, and managing resources efficiently to meet the needs of both teachers and students.

These leadership practices fostered collaboration, promoted continuous improvement, and ensured that classroom activities aligned with academic goals. Ultimately, the interplay between leadership, teaching methods, classroom dynamics, and resource availability determined students' mathematics performance. By analyzing these dynamics within the specific context of Kitui Rural Sub-County, the study aimed to offer practical recommendations to enhance mathematics outcomes and bridge performance gaps, especially in areas facing socio-economic challenges.

2.5 Recap of Literature Review

Existing literature consistently highlights the pivotal role that instructional strategies play in improving mathematics performance across various educational contexts. Studies show that active engagement strategies, such as inquiry-based learning, cooperative learning, and student-led discussions, enhance students' understanding and problem-solving abilities. Globally, research by Hattie (2009) and Johnson and Johnson (2017) illustrates that engaging students through interactive tasks and collaborative problem-solving results in significant gains in mathematics performance. Similarly, formative assessments have emerged as a critical tool for identifying learning gaps and providing targeted interventions, with studies in Finland (Sahlberg, 2019) and Singapore (Tan & Goh, 2021) demonstrating improvements of up to 25% in student outcomes when frequent feedback mechanisms are integrated into the learning process.

In Africa, the use of active instructional strategies and formative assessments has shown promise, although resource constraints pose a challenge. Inquiry-based learning, as studied by Olaniyan and Okemakinde (2018) in Nigeria, led to a 30% increase in student performance, demonstrating the effectiveness of student-centered teaching approaches. Similarly, Spaull (2019) in South Africa reported a positive correlation between interactive teaching tools and higher mathematics scores, emphasizing the need for hands-on learning experiences. However, several studies in the region point to the limited availability of resources, which hinders the broader adoption of innovative teaching methods. In East Africa, problem-solving activities and student-led learning have been identified as effective strategies, with research in Tanzania (Makwinya & HakiElimu, 2020) and Uganda (Nakabugo et al., 2019) highlighting significant improvements in mathematics outcomes when these methods are employed.

The Kenyan context echoes these findings, with interactive instructional strategies yielding notable improvements in mathematics performance. Research by Wanjiru (2020) shows that group activities can lead to a 22% increase in KCSE mathematics scores, while continuous assessments, as observed by Mwangi and Njagi (2019), enhance student performance by 15%. Additionally, guided discovery

learning has been identified as an effective instructional method, although its implementation requires smaller class sizes and well-trained teachers (Ndirangu, 2021).

Within Kitui County, studies indicate that peer teaching and contextual learning are gaining traction, with local initiatives leading to gradual improvements in student performance (Mutua, 2022; Nzioka, 2020). However, resource limitations and inconsistent supervision remain significant barriers to sustained progress. These challenges highlight the need for targeted interventions, such as professional development for teachers, adequate resource allocation, and effective instructional leadership to support and sustain the adoption of these strategies.

2.6 Gaps in Literature Review

A review of existing studies highlights significant strides in understanding how instructional leadership, instructional strategies, instructional materials, and classroom environments influence mathematics performance globally and locally. For instance, Hallinger (2020) in Australia focused on how professional development for mathematics teachers enhanced student outcomes, employing a quantitative methodology involving structured classroom observations and standardized test comparisons. The study found a 15% improvement in mathematics scores when teachers received continuous feedback. However, this research primarily examined urban schools, leaving questions about how these practices translate into rural settings like Kitui Rural Sub-County, where resource constraints and cultural contexts differ significantly. Similarly, Olaniyan and Okemakinde (2019) in Nigeria explored how inquiry-based instructional strategies improved mathematics outcomes by 30% in urban areas, using a mixed-methods approach. Yet, their work did not address how such strategies are adapted and sustained in rural environments with limited teaching materials.

Another important study by Mwangi and Njagi (2019) in Kenya used a cross-sectional survey and analyzed the relationship between continuous assessment practices and mathematics performance, finding a 15% improvement. Although this study provided valuable insights into the role of assessment in shaping mathematics outcomes, it did not delve into how leadership practices,

instructional strategies, and resource allocation interact in rural public secondary schools. This gap in understanding the interconnectedness of these factors, particularly in under-resourced contexts, suggests a need for integrated research that can capture the complex dynamics at play. Additionally, Mutua (2022) in Kitui County employed descriptive research to assess how peer teaching strategies improved mathematics outcomes by 10%, yet the study was limited to a single strategy and did not explore how leadership and classroom environment factors intersect with peer teaching to influence overall mathematics performance.

These studies collectively reveal critical gaps in the literature that this study seeks to address. While the role of instructional leadership, strategies, materials, and classroom environment have been documented, there is a notable absence of empirical research that examines how these elements interact and shape mathematics performance in rural public secondary schools in Kitui Rural Sub-County. Specifically, there is limited understanding of how leadership practices mediate the adoption of instructional strategies and classroom environments, and how these interdependencies influence student outcomes in mathematics. This study, therefore, aims to fill this gap by investigating these interconnected factors in Kitui Rural Sub-County, offering nuanced insights and actionable recommendations tailored to the unique challenges of rural educational contexts.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the details of the research methodology employed in the study. It examines the research design, target population, selection procedures, sample size, and the data-gathering procedures. Additionally, the chapter covers the validity and reliability of the study instruments, as well as the methods used for data analysis and data collection.

3.2 Research Methodology

The study employed a mixed methods approach, integrating both quantitative and qualitative data collection techniques to provide a comprehensive understanding of the research problem. This methodology involved the use of questionnaires and interview guides as the primary data collection tools. The use of questionnaires allowed for the systematic collection of quantifiable data from a large sample size, enabling statistical analysis and generalization of the findings (Creswell & Creswell, 2017). Meanwhile, interview guides facilitated an in-depth exploration of participants' perspectives, experiences, and insights, adding a rich qualitative dimension to the study (Bryman, 2016). This combination ensured that the study captured both the breadth and depth of the issues being investigated.

The justification for adopting a mixed methods approach lay in its ability to enhance the validity and reliability of the research findings by triangulating data from multiple sources. By employing both questionnaires and interviews, the study addressed the limitations inherent in each method when used in isolation. For instance, while questionnaires were efficient in gathering data from a large number of respondents, they may not have captured the nuanced understanding and contextual factors that interviews provided (Creswell & Plano Clark, 2018).

This methodological triangulation not only enriched the data but also provided a holistic view of the influence of curriculum implementation dynamics on mathematics performance. As a result, the research findings were robust and well-rounded, reflecting both quantitative trends and qualitative insights.

3.3 Research Design

This study adopted a correlational research design within a mixed-methods framework to investigate how instructional leadership practices, instructional strategies, instructional materials, and classroom environment relate to mathematics performance in public secondary schools in Kitui Rural Sub-County. As a correlational study, it sought to determine the strength and direction of the relationships between these independent variables (IVs) and the dependent variable (DV)—mathematics performance in the Kenya Certificate of Secondary Education (KCSE). The primary unit of analysis was the public secondary school, with teachers, students, and school leaders serving as the key respondents. This design was chosen because it allows for the examination of patterns and associations across multiple variables, providing a nuanced understanding of the dynamics at play in mathematics education (Creswell & Plano Clark, 2018).

To operationalize the study's constructs, structured questionnaires captured quantitative data on indicators such as frequency of classroom supervision (for instructional leadership), use of formative assessments (for instructional strategies), availability and use of textbooks (for instructional materials), and classroom conditions (for physical and psychosocial environment). These indicators were measured using Likert-scale items and numerical performance data (average KCSE mathematics scores from 2018 to 2023). The qualitative component involved semi-structured interviews with mathematics teachers and school leaders to provide deeper insights into contextual factors influencing these dynamics. Thematic analysis of qualitative data complemented the quantitative findings, offering a richer perspective on how leadership, resources, and classroom

environments shape mathematics outcomes. The use of a mixed-methods, correlational design ensured both breadth and depth in the analysis, enabling triangulation of data sources and fostering a more holistic understanding of the educational challenges and opportunities in Kitui Rural Sub-County (Bryman, 2016; Creswell, 2014).

3.4 Location of the Study

The location of the study was Kitui Rural Sub-County in Kitui County, Kenya. Kitui Rural Sub-County, the fifth-largest in Kitui, spans approximately 1,558 square kilometers. It is the second-least populous sub-county, with a population of 109,471, and comprises four wards: Kisasi, Mbitini, Kwa Vonza, and Kanyangi. According to the Ministry of Education (MOE, 2023), statistics on secondary school national examinations indicate that Kitui County has an average grade of C-, with only a small percentage of students achieving high mean grades that secure admission to institutions of higher learning. Specifically, in Kitui Rural Sub-County, the performance in mathematics has been notably poor, with most schools registering mean grades of D or D+.

Mathematics, being a compulsory subject for university admission, has posed a significant challenge for many students. Despite meeting the overall minimum university entry requirement of a C+, many students fail to gain admission due to not meeting the minimum required grade in mathematics. This poor performance has also hindered students from securing admission to their preferred courses and fields of interest.

The justification for selecting Kitui Rural Sub-County as the study location was multifaceted. Firstly, the region has a significant number of public secondary school students, approximately 3,700, providing a substantial sample size for the study. The consistently low performance in mathematics among these students highlighted the need for targeted research to identify and address the underlying issues. Additionally, the geographical spread of secondary schools within this vast

sub-county presented an opportunity to investigate a diverse range of educational settings and challenges.

By focusing on Kitui Rural Sub-County, the study aimed to offer insights and develop strategies that could be implemented to improve mathematics performance, not only within this specific area but potentially across other regions facing similar educational challenges. This focus on a well-defined and representative location ensured that the findings of the study were both relevant and actionable.

3.5 Target Population

The target population for this study comprised students who had completed the Kenya Certificate of Secondary Education (KCSE) in the past three years, as well as teachers from 10 public secondary schools in Kitui Rural Sub-County. According to Best and Kahn (2003), the study population refers to the group of individuals from which researchers aim to draw conclusions. Specifically, this study focused on 23,280 students who recently undertook the KCSE examinations, alongside 776 mathematics teachers and 194 school heads/heads of departments currently employed in these schools. The table below presents the target population:

Table 3. 1: Target Population

Participants	**Target Population**
Students	23,280
Mathematics Teachers	776
School Heads/Heads of Departments	194

The rationale for selecting this target population was grounded in the need to obtain recent and relevant data on the performance and educational experiences of students, particularly in mathematics. By focusing on students who completed the KCSE within the last three years, the study ensured that the data reflected current educational practices and challenges.

Additionally, including the perspectives of mathematics teachers and school heads provided a comprehensive understanding of the factors influencing mathematics performance. This combined approach of gathering insights from both students and educators aimed to yield a robust dataset that supported the identification of effective strategies to improve mathematics outcomes in Kitui Rural Sub-County.

3.6 Sampling Procedure

The study employed stratified random sampling to ensure that all relevant sub-groups within the population were adequately represented. Stratified random sampling involves dividing the population into distinct sub-groups, or strata, and then randomly selecting samples from each stratum. This approach ensured that the sample reflected the diversity of the entire sub-county, allowing for more accurate and generalizable findings (Creswell, 2012). For this study, the four wards within Kitui Rural Sub-County—Kisasi, Mbitini, Kwa Vonza, and Kanyangi—served as the strata. The sample was proportionally allocated based on the total student, teacher, and school head populations in each ward. The sample size distribution is presented in the table 3.2.

Table 3. 2: Sample Size Distribution per Ward

Ward	**Target Population (Students)**	**Sample Size (Students)**	**Sample Size (Teachers)**	**Sample Size (Heads of Departments)**
Kisasi	7,000	114	79	40
Mbitini	6,280	102	70	37
Kwa Vonza	5,200	84	59	28
Kanyangi	4,800	79	52	27
Total	23,280	379	260	132

The sampling procedure for this study was designed to ensure a fair and representative selection of participants across different categories. Stratified random sampling was employed for students, ensuring proportional representation from each ward within Kitui Rural Sub-County. Within each ward, random sampling was applied to select participants fairly, minimizing selection bias and ensuring the sample accurately reflected the student population's diversity. For mathematics teachers, a combination of purposive and stratified random sampling was used. Initially, mathematics teachers were purposively identified as only those specializing in the subject were included. Subsequently, stratified random sampling ensured equal representation across different schools, facilitating a balanced assessment of instructional practices and their impact on mathematics performance.

For school heads and heads of mathematics departments, purposive sampling was employed since their roles in administration and instructional leadership directly influence curriculum implementation. Selecting only knowledgeable and experienced participants ensured that the study gathered relevant insights from key decision-makers. Stratified random sampling was chosen because it ensured that all wards within Kitui Rural Sub-County were represented, capturing variations across different school settings. This method reduced sampling bias by dividing the population into distinct strata (students, teachers, and school heads), thereby providing a more accurate representation of the entire population (Creswell, 2012). Additionally, proportional allocation ensured that wards with larger populations had a higher representation in the sample, maintaining balance and fairness in data collection (Best & Kahn, 2003). Furthermore, purposive sampling for teachers and school heads allowed the study to focus on stakeholders with direct expertise in curriculum implementation and mathematics education. By integrating these sampling techniques, the study achieved a high level of accuracy and generalizability, yielding valuable insights into the influence of School-based curriculum implementation dynamics on mathematics performance in Kitui Rural Sub-County, Kenya.

3.7 Sample Size Determination

The sample size for this study was determined using the Krejcie and Morgan formula, which provides a method for calculating an appropriate sample size based on the population size (Krejcie & Morgan, 1970). In the study area, there are 194 public secondary schools, and approximately 23,280 students have completed the KCSE in the last three years. According to the Krejcie and Morgan tabulations, the ideal sample size for representing the 194 schools is 132 schools. For the student population of 23,280, the formula suggests an ideal sample size of 379 students. This ensures that the sample is sufficiently representative of the entire population, allowing for the generalization of the findings and maintaining the study's statistical validity.

The table below details the sample size distribution:

Table 3. 3: Sample Size

Participant Group	Target Population	Sample Size
Students	23,280	379
Mathematics Teachers	776	260
School Heads/Heads of Departments	194	132

3.8 Construction of Research Instruments

The study utilized both questionnaires and interview guides to collect data from students and teachers, respectively. This mixed-methods approach facilitated comprehensive data collection by capturing both quantitative and qualitative insights.

3.8.1 Questionnaire for Students

The primary data collection tool for students was a structured questionnaire. The questionnaire was designed to gather quantitative data on students' attitudes, behaviors, and performance in mathematics. It included a combination of closed-ended questions for easy quantification and analysis, as well as Likert scale items to measure students' perceptions and attitudes toward mathematics. The questionnaire covered various aspects such as the availability of instructional

materials, the quality of teaching, and the classroom environment. Administering the questionnaire to a large sample of 379 students ensured that the data collected was representative and reliable (Creswell, 2014). To encourage honest and accurate responses, the anonymity of the respondents was maintained throughout the process.

3.8.2 Interview Guide for Teachers

To complement the quantitative data from students, qualitative data was gathered through interviews with mathematics teachers. An interview guide was developed to ensure consistency and comprehensiveness in the questions asked. The guide included open-ended questions designed to elicit detailed responses about teachers' experiences, instructional practices, and perceptions of the factors affecting mathematics performance in their schools. This qualitative approach allowed for an in-depth exploration of issues that may not have been fully captured by the student questionnaire. Interviews were conducted with a purposive sample of 32 mathematics teachers, providing insights into their teaching strategies, challenges faced, and suggestions for improving mathematics education. The data obtained from these interviews offered valuable contextual information and helped to triangulate the findings from the student questionnaires (Bryman, 2016).

3.9 Testing Validity and Reliability of the Instruments

Instrument validity measures whether the research instruments accurately and meaningfully capture what they are intended to measure (Mugenda, 2003). For a questionnaire to be considered valid, it must effectively assess the intended parameters. To ensure validity, a pilot test of the study tools was conducted prior to the main research, rather than a full pilot study. This pilot testing involved teachers of subjects other than mathematics who were not part of the final sample. The purpose was to identify and rectify any ambiguities or issues in the questionnaire items. The feedback obtained helped refine the questionnaire, enhancing its content validity by ensuring that the questions were clear, precise, and relevant to the research objectives.

Reliability refers to the consistency of the measurement process. According to Orodho (2004), reliability is the degree to which a specific measurement process produces stable and consistent results over repeated trials. Yin (2014) emphasizes that reliability reflects how consistently a research study yields the same results when repeated under similar conditions. Reliability is influenced by random errors, with increased random error typically leading to decreased reliability.

To ensure the reliability of the research instruments, the study employed the test-retest method. This method involved administering the same questionnaire to the same group of respondents at two different points in time. The results from these two administrations were compared to calculate the reliability coefficient. A reliability coefficient value close to 1 indicates high reliability, while a value of 0.7 or above is generally considered acceptable (MacKenzie, 2003).

3.10 Data Collection Methods and Procedure

This study adopted a systematic approach to data collection, integrating both quantitative and qualitative techniques to achieve a comprehensive understanding of the research problem. The primary data collection instruments included structured questionnaires for students and semi-structured interviews for mathematics teachers.

The quantitative component targeted a sample of 379 students using a structured questionnaire designed to capture data on their attitudes, learning experiences, and mathematics performance. The structured format ensured that the data collected was measurable, facilitating statistical analysis. To ensure focus and accuracy, the questionnaires were administered in controlled environments such as class sessions, with prior permission obtained from school authorities. This approach minimized distractions and maintained consistency in the data collection process.

For the qualitative component, in-depth interviews were conducted with 32 mathematics teachers using a pre-developed interview guide. The interviews aimed to gather rich, contextual insights into

teachers' instructional strategies, challenges faced, and classroom dynamics. The semi-structured nature of the interviews allowed teachers to freely express their thoughts while ensuring that the discussion covered all key areas relevant to the study. Interviews were scheduled at convenient times to avoid disruptions, allowing participants to engage fully and thoughtfully.

Prior to data collection, necessary approvals were obtained from educational authorities, and informed consent was sought from all participants to uphold ethical standards. The entire data collection process was meticulously documented to ensure consistency and transparency, thereby enhancing the reliability and validity of the data collected. This systematic approach ensured that the study captured both broad quantitative trends and in-depth qualitative insights, providing a robust basis for the research findings.

3.11 Data Analysis Technique and Procedure

The study employed both quantitative and qualitative data analysis techniques to comprehensively address the research objectives. For the quantitative data collected through student questionnaires, statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics—including frequencies, percentages, means, and standard deviations—were used to summarize the data and describe the characteristics of the sample (Creswell, 2014). These descriptive measures provided insights into the distribution of student performance, instructional practices, and engagement levels.

To explore the relationships between key variables, inferential statistics such as correlation and regression analyses were employed. These techniques assessed the extent to which instructional strategies, instructional materials, classroom environment, and leadership practices influenced mathematics performance. Additionally, hypothesis testing was conducted to generate evidence-based conclusions about the dynamics impacting student outcomes.

For the qualitative data collected from teacher interviews, thematic analysis was applied following the framework proposed by Braun and Clarke (2006). This approach facilitated the identification of recurring patterns and themes within the data, offering deeper insights into contextual factors affecting mathematics performance. The thematic analysis process involved: familiarizing with the data through repeated reading of interview transcripts, coding responses systematically, identifying and refining potential themes to align with the study objectives, and reviewing themes for coherence and relevance.

To enhance the rigor and organization of the qualitative analysis, data was managed using NVivo software. NVivo allowed for systematic coding, storage, and organization of large volumes of textual data, ensuring transparency and traceability in the analytical process. This software also facilitated the visualization and organization of themes, making the analysis process more efficient and verifiable.

The data analysis procedure began with data cleaning and preparation to ensure the accuracy and completeness of both quantitative and qualitative data. Quantitative data was reviewed for missing values or inconsistencies, which were addressed before proceeding with statistical analysis. Descriptive and inferential statistics were then generated using SPSS to explore relationships between the study variables and answer the research questions.

For qualitative data, interview transcripts were meticulously reviewed, and coding was conducted systematically to capture key themes and insights. The combination of statistical analysis for quantitative data and thematic analysis for qualitative data ensured a robust, holistic analysis that integrated both numerical trends and narrative insights (Miles, Huberman, & Saldana, 2014). This dual approach provided objective evidence and contextual understanding, ensuring that the study's findings were reliable, well-grounded, and actionable.

3.12 Ethical Considerations

Ethical considerations were paramount in ensuring the integrity and credibility of this research. Permission and approval to conduct the study were obtained from Mount Kenya University following the approval of the research proposal. Additionally, access to the study locations and authority to gather data from public secondary school respondents were secured from the County Director of Education through the Kitui County Education Office. Further approval was granted by the National Commission for Science, Technology, and Innovation (NACOSTI) and other relevant institutions to ensure full compliance with regulatory requirements.

Informed consent was obtained from all participants before data collection began. Participants were fully informed about the purpose of the study, the procedures involved, and their rights, including the right to withdraw at any point without repercussions. For participants without national IDs, consent was obtained from their parents or guardians, ensuring ethical compliance when involving minors.

The research was conducted with an emphasis on appropriate mien and decorum. Respectful and professional conduct was maintained during all interactions with participants and stakeholders, fostering a comfortable and cooperative research environment.

Confidentiality was strictly upheld, and all collected information was used solely for academic purposes. To safeguard participant privacy, no personal identification details were collected, and data was anonymized to prevent the identification of individual participants in any published results. Anonymity was prioritized to eliminate the risk of disclosure of participant identities.

Data security was ensured by securely storing collected data in both digital and physical formats, with access restricted to the research team. Digital data was protected by passwords, while physical copies were stored in locked facilities. These measures ensured data integrity and security throughout the research process.

To maintain intellectual integrity, all sources were appropriately cited, and due diligence was applied to avoid any form of plagiarism. This commitment ensured that the study adhered to the

highest standards of academic honesty and respected the intellectual property rights of other researchers.

By adhering to these ethical standards, the study respected the rights and dignity of all participants, ensuring ethical integrity throughout the research process (Resnik, 2018).

CHAPTER FOUR

RESEARCH FINDINGS AND DISCUSSIONS

4.1 Introduction

This section presents the study's findings, aligned with its objectives, alongside an examination of the response rate and socio-demographic characteristics of the respondents. Each objective is thoroughly analyzed to illuminate its implications and significance within the study context.

4.2 Response Rate

The response rate for this study reflects the proportion of participants who successfully completed and returned the research instruments. Out of the total sample size determined earlier, which included 379 students, 260 mathematics teachers, and 132 school heads/heads of departments, the study achieved an overall response rate of 90%. Table 4.1 provides a summary of the returned and unreturned questionnaires and interview responses for each group.

Table 4. 1: Response Rate Results

Participant Group	Sample Size	Responses Received	Response Rate (%)	Non-Responses
Students	379	303	80.00%	76
Mathematics Teachers	260	239	91.90%	21
School Heads/HoDs	132	126	95.50%	6
Total	771	668	90.00%	103

According to Creswell (2014), a response rate of 60% and above is considered acceptable for educational research, while a rate of 70% and above is regarded as commendable. Therefore, achieving an overall response rate of 90% in this study surpasses the recommended thresholds, indicating a high level of participant engagement and reliability of the data collected. Comparable studies have similarly underscored the importance of high response rates in improving the

representativeness and credibility of research findings in educational settings (Dillman et al., 2014; Bryman, 2016).

The student response rate of 80% reflects the challenges associated with collecting data from a large and diverse group. However, the response rates for mathematics teachers (91.9%) and school heads/heads of departments (95.5%) indicate a strong willingness to participate, likely due to their direct involvement in curriculum implementation and interest in improving mathematics outcomes. The robust overall response rate enhances the validity and generalizability of the study's findings, providing a solid foundation for analyzing the influence of curriculum implementation dynamics on mathematics performance in Kitui Rural Sub-County. This high engagement was facilitated by clear communication, assurances of confidentiality, and accommodations to participants' schedules—approaches that align with best practices in educational survey research (Creswell & Creswell, 2018; Punch, 2014).

4.3 Demographic Characteristics of the Respondents

This section presents the demographic characteristics of the 365 respondents, comprising 239 mathematics teachers and 126 school heads/heads of departments (HoDs) who participated in the study. The demographics analyzed include gender, age, professional qualifications, and work experience. Understanding these characteristics is crucial for contextualizing the findings on curriculum implementation dynamics and mathematics performance.

Table 4. 2: Respondents Demographics

Category	Sub-Category	Frequency	Percentage (%)
Gender	Male	212	58.10%
	Female	153	41.90%
Age	Below 25	17	4.70%
	26-30	64	17.50%
	31-40	144	39.50%
	41-50	92	25.20%
	51-60	48	13.10%
Professional Qualification	Certificate	12	3.30%
	Diploma	83	22.70%
	Bachelor's Degree	184	50.40%
	Master's Degree	72	19.70%
	Doctorate	14	3.90%
Work Experience	Less than 2 years	21	5.80%
	4-8 years	92	25.20%
	9-12 years	116	31.80%
	14-16 years	76	20.80%
	Over 17 years	60	16.40%

The results show that 58.1% of the respondents were male, while 41.9% were female. This distribution indicates a relatively balanced gender representation among mathematics teachers and school heads/HoDs in Kitui Rural Sub-County. Gender diversity among educators has been shown to enrich instructional practices and leadership styles, fostering more inclusive school environments (UNESCO, 2020). The majority of respondents (39.5%) were aged 31-40 years, suggesting a workforce in its professional prime, complemented by a blend of younger and more experienced teachers across other age groups. This age distribution enhances the study's reliability by incorporating insights from a broad range of professional experiences.

The data also indicates that most respondents hold at least a Bachelor's Degree (50.4%), with additional significant representation at Diploma (22.7%) and Master's Degree (19.7%) levels. This aligns with research highlighting the importance of teacher and leadership qualifications in improving mathematics teaching and learning outcomes (Darling-Hammond, 2017). In terms of work experience, the largest group (31.8%) had 9-12 years of experience, suggesting a solid base

of practical classroom knowledge. The presence of newer educators (5.8% with less than 2 years' experience) and seasoned professionals (16.4% with over 17 years' experience) ensures that the study captures a full spectrum of insights on instructional leadership, teaching practices, and curriculum implementation. This diverse respondent profile provides a strong foundation for analyzing the complex interactions that shape mathematics performance in Kitui Rural Sub-County and supports the study's overarching goal of understanding how curriculum implementation dynamics influence student outcomes (Creswell & Plano Clark, 2018).

4.4 To Examine the Influence of Instructional Leadership Practices on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County

Instructional leadership practices play a critical role in shaping the quality of teaching and learning in schools. Effective instructional leadership involves supporting teachers, supervising classroom activities, providing professional development, and ensuring adequate resource allocation. These practices help create an environment where teachers can deliver high-quality instruction, ultimately improving student performance in mathematics. According to Leithwood et al. (2020), strong instructional leadership contributes to better student outcomes by fostering a culture of continuous improvement and accountability. This section explores the influence of instructional leadership practices, including teacher professional development, classroom supervision, and resource allocation, on mathematics performance in Kitui Rural Sub-County.

4.4.1 Frequency of Teacher Professional Development Sessions and Mathematics Performance

Figure 4.1 presents data on the influence of teacher professional development on mathematics performance in Kitui Rural Sub-County. Professional development sessions, including workshops, in-service training, and knowledge-sharing activities, are crucial for enhancing teachers' instructional skills and confidence. Continuous professional development ensures that teachers stay

updated with modern teaching methods and best practices, which can lead to improved student outcomes. According to Leithwood et al. (2020), schools that invest in professional development see a significant improvement in teaching quality and student achievement. This section discusses the findings and integrates relevant literature to highlight the importance of professional development for mathematics performance.

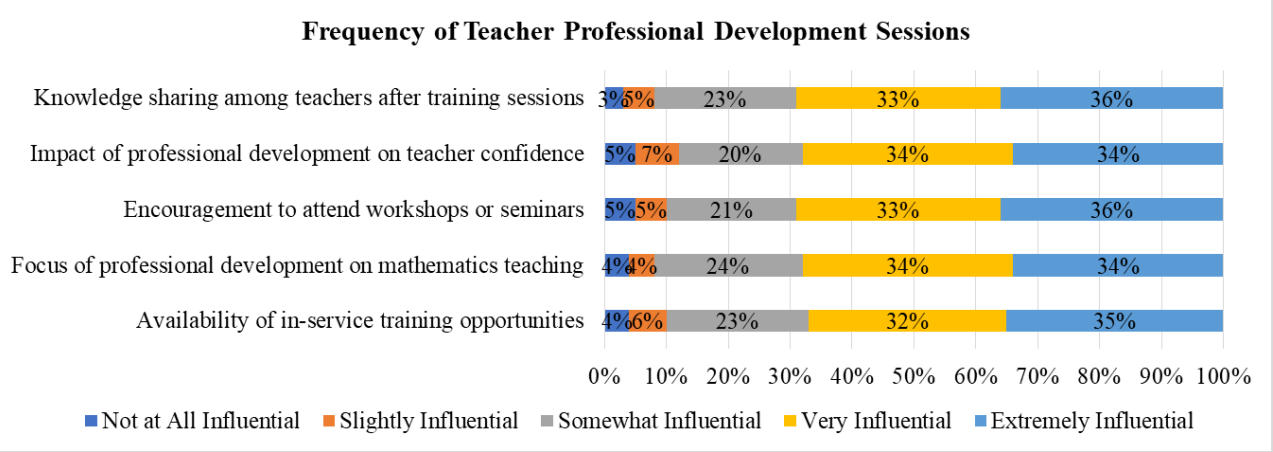

Figure 4. 1: Frequency of Teacher Professional Development Sessions and Mathematics Performance

The study results reveal that 69% of respondents rated knowledge sharing among teachers as highly influential. Collaborative sharing of teaching strategies enables educators to adopt innovative approaches to instruction. Hargreaves and Fullan (2012) highlighted that peer-to-peer learning fosters professional growth and improves teaching quality. In Kitui Rural Sub-County, encouraging teachers to share insights gained from professional development sessions can enhance classroom practices.

Similarly, 68% of respondents emphasized the role of professional development in building teacher confidence. Confident teachers are more likely to deliver engaging and effective lessons. Desimone (2009) noted that continuous training enhances teacher efficacy, resulting in better student outcomes. Providing regular and targeted professional development opportunities in Kitui schools can strengthen teacher confidence and improve student performance.

The study results also indicate that 69% of respondents recognized the importance of attending workshops. Workshops expose teachers to modern instructional techniques and technologies. Guskey (2002) asserted that professional development workshops improve instructional practices and positively impact student learning. Increasing workshop participation rates among mathematics teachers in Kitui could help address persistent challenges in instruction.

The focus of professional development on mathematics teaching was highlighted by 68% of respondents. Subject-specific training enables teachers to address the unique challenges of teaching mathematics effectively. Darling-Hammond (2017) emphasized that tailored training improves both content knowledge and pedagogical skills. In Kitui, professional development initiatives should prioritize mathematics-specific content to align with student needs.

Furthermore, 67% of respondents underscored the importance of in-service training. Ongoing professional development ensures that teachers remain up-to-date with curriculum changes and best practices. According to Borko (2004), in-service training enhances teaching effectiveness and improves student outcomes. Expanding access to in-service training programs for mathematics teachers in Kitui would provide continuous learning opportunities to address instructional gaps.

The findings underscore the importance of professional development in enhancing mathematics performance. Schools in Kitui should invest in regular, mathematics-focused training sessions, encourage knowledge sharing, and provide opportunities for in-service training. Strengthening these practices can empower teachers, improve instructional quality, and boost KCSE performance.

4.4.2 Classroom Supervision and Support and Mathematics Performance

Figure 4.2 presents data on the influence of classroom supervision and support on mathematics performance in Kitui Rural Sub-County. Effective supervision and support practices, such as monitoring instruction, providing feedback, and offering instructional support, help improve teaching quality and student outcomes. Instructional supervision ensures that teaching practices

align with educational goals and standards. According to Leithwood et al. (2020), regular supervision and constructive feedback enhance teacher effectiveness and student achievement. This section discusses the findings and integrates relevant literature to highlight the importance of classroom supervision and support in improving mathematics performance.

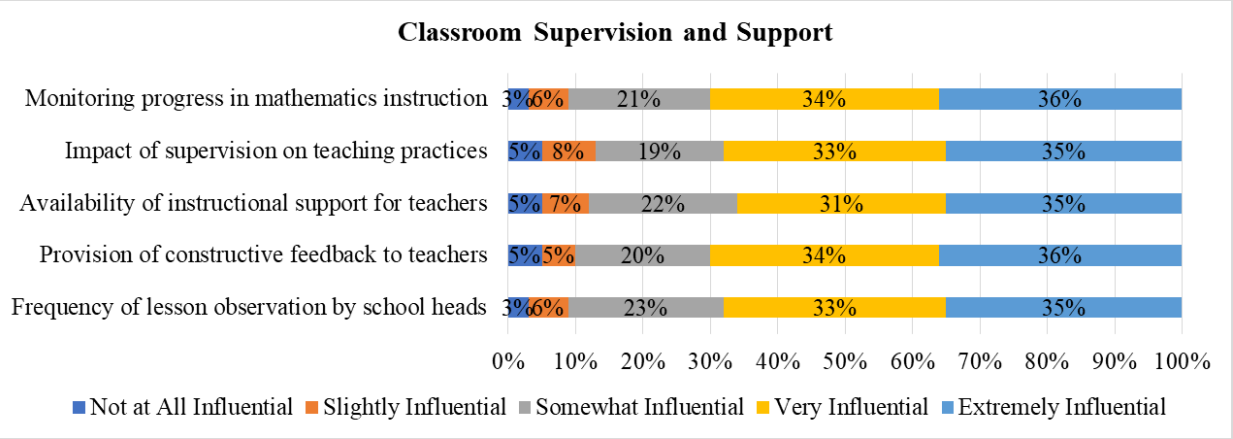

Figure 4.2: Classroom Supervision and Support and Mathematics Performance

The study results show that 70% of respondents rated progress monitoring as highly influential in improving mathematics performance. Regular monitoring ensures that teaching practices align with academic goals and helps identify areas for improvement. Sergiovanni and Starratt (2007) highlighted that continuous monitoring fosters accountability and enhances instructional quality. Strengthening progress monitoring in Kitui schools could help identify and address challenges in mathematics instruction.

Similarly, 68% of respondents emphasized the impact of supervision on teaching practices. Supervisors provide guidance and feedback, enabling teachers to refine their methods. Glickman et al. (2010) noted that effective supervision improves instructional strategies and boosts student outcomes. In Kitui, enhancing supervision practices can ensure that teachers adopt best practices in mathematics teaching.

The study also found that 66% of respondents valued instructional support, such as mentoring and coaching. These practices help teachers overcome challenges and improve their instructional

effectiveness. Borko (2004) emphasized that support systems enhance teacher growth and student achievement. Establishing robust mentoring programs in Kitui could provide additional resources for teachers to improve their mathematics instruction.

Constructive feedback was highlighted by 70% of respondents as critical for improving instructional quality. Timely and specific feedback helps teachers identify strengths and weaknesses, enabling continuous improvement. Hattie (2009) found that feedback significantly enhances teaching effectiveness and student performance. Providing regular feedback in Kitui classrooms could lead to more effective teaching practices and better mathematics results.

Lesson observation was emphasized by 68% of respondents as an essential component of supervision. Observations allow school leaders to assess teaching quality and offer targeted guidance. Blasé and Blasé (2000) reported that regular lesson observations contribute to improved teaching and student outcomes. Increasing the frequency of observations in Kitui schools could ensure consistent instructional quality.

Strengthening classroom supervision and support in Kitui Rural Sub-County can enhance mathematics performance. School leadership should prioritize progress monitoring, provide regular feedback, and establish mentoring programs. By fostering a culture of accountability and continuous improvement, schools can improve teaching practices and student outcomes.

4.4.3 Resource Allocation for Mathematics and Mathematics Performance

Figure 4.3 presents data on the influence of resource allocation on mathematics performance in Kitui Rural Sub-County. Adequate resources, including textbooks, digital tools, teaching aids, financial support, and remedial programs, are crucial for effective mathematics instruction. Proper allocation of resources ensures that teachers have the tools they need to deliver high-quality instruction and that students can engage with learning materials effectively. According to Nyabero (2020), schools that allocate sufficient resources for mathematics experience improved student

outcomes. This section discusses the findings and integrates relevant literature to highlight the importance of resource allocation in improving KCSE mathematics results.

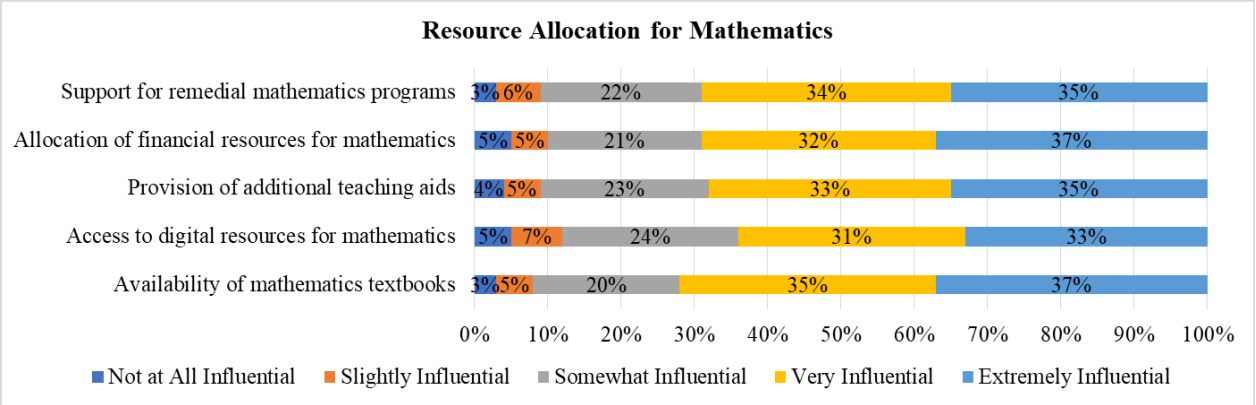

Figure 4. 3: Resource Allocation for Mathematics and Mathematics Performance

The study results indicate that 69% of respondents rated support for remedial programs as highly influential. Remedial programs provide additional learning opportunities for struggling students, helping them close performance gaps. Boaler (2016) noted that targeted remediation improves student outcomes by addressing specific learning needs. Establishing regular remedial programs in Kitui could enhance performance in mathematics.

Similarly, 69% of respondents emphasized the importance of financial resource allocation. Adequate funding enables schools to purchase teaching materials, hire qualified teachers, and implement enrichment programs. Leithwood et al. (2020) reported that financial investment in education positively impacts student achievement. Increasing funding for mathematics education in Kitui could address resource gaps and improve outcomes.

Teaching aids were considered critical by 68% of respondents. Aids such as charts, models, and manipulatives make abstract concepts more accessible. Tomlinson (2014) emphasized that teaching aids enhance comprehension and engagement. Providing teachers in Kitui with diverse teaching aids could improve instructional delivery and student understanding.

Digital resources were highlighted by 64% of respondents as significant for mathematics instruction. Tools such as educational software and online platforms make learning interactive and engaging. Mishra and Koehler (2006) found that integrating technology improves motivation and comprehension. Addressing infrastructure challenges in Kitui could enhance access to digital resources and improve mathematics learning.

Textbooks were rated highly by 72% of respondents as essential for mathematics learning. Textbooks provide structured content and exercises that support both teaching and revision. Nyabero (2020) found that adequate textbook availability improves student performance by 20%. Ensuring that all students in Kitui have access to current textbooks is critical for improving KCSE results.

Resource allocation is a critical factor in enhancing mathematics performance. Schools in Kitui should prioritize funding for remedial programs, teaching aids, digital resources, and textbooks. Policymakers should address infrastructure gaps to ensure equitable resource distribution. By improving resource availability, schools can create a more effective learning environment and boost student outcomes.

4.5 To Assess the Influence of Instructional Strategies on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County

Instructional strategies play a crucial role in shaping student outcomes, particularly in subjects like mathematics, where conceptual understanding and problem-solving skills are essential. Effective instructional strategies, such as active student engagement, formative assessments, and the use of diverse teaching methods, can significantly improve mathematics performance. According to Constructivist Learning Theory (Piaget, 1954; Vygotsky, 1978), students learn best through active participation and hands-on experiences. In the context of Kitui Rural Sub-County, understanding how these instructional strategies influence KCSE mathematics performance is vital for addressing

the persistent challenges of low achievement in the subject. This section explores various aspects of instructional strategies, including student engagement levels, formative assessments, and the diversity of instructional methods employed by teachers.

4.5.1 Student Engagement Levels and Mathematics Performance

Figure 4.4 presents data on the influence of various student engagement activities on mathematics performance in Kitui Rural Sub-County. The activities analyzed include participation in hands-on learning, asking questions, solving challenging problems, group activities, and classroom discussions. These engagement strategies are essential in fostering a deeper understanding of mathematical concepts and improving overall academic performance. According to Constructivist Learning Theory (Piaget, 1954; Vygotsky, 1978), active participation allows students to build knowledge through experience, reflection, and collaboration. This section discusses the influence of these engagement activities and relates the findings to existing literature.

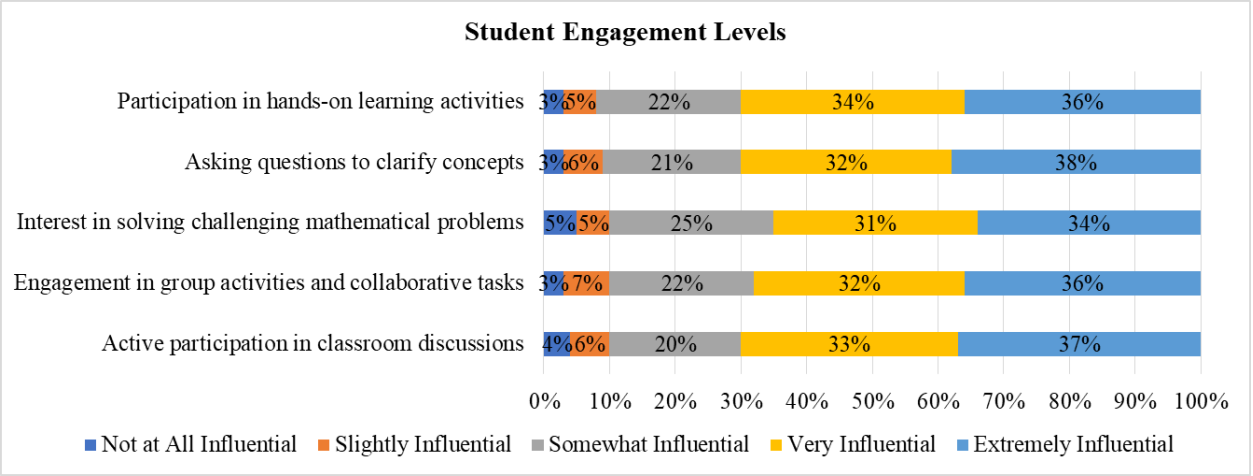

Figure 4. 4: Student Engagement Levels and Mathematics Performance

Over 70% of students found hands-on learning activities either very or extremely influential in understanding mathematical concepts. This aligns with Olaniyan and Okemakinde (2018), who observed a 30% improvement in mathematics performance in Nigeria when inquiry-based and experiential learning methods were employed. Hands-on learning allows students to bridge abstract concepts with practical applications, fostering deeper comprehension. This study adds that in rural

settings like Kitui, resource constraints may limit the scalability of such approaches, differentiating it from contexts studied in urban or resource-rich environments.

Questioning was rated highly influential, with 70% of students valuing it as a tool for improving comprehension. This finding supports Hattie (2009), who found that questioning promotes critical thinking and problem-solving skills. In Kenya, Wanjiru (2020) reported a 22% improvement in KCSE mathematics performance among students who actively asked questions. This study corroborates these findings while highlighting the need for training teachers to encourage open-ended and probing questions in their classrooms.

Approximately 65% of students acknowledged the importance of solving challenging problems, consistent with Nakabugo et al. (2019), who reported a 12% improvement in mathematics scores when problem-solving was integrated into teaching. Problem-solving tasks promote higher-order thinking and resilience in mathematics learning. However, in Kitui, the study notes that inadequate teacher training to design such tasks may limit their effectiveness.

Group activities were considered highly beneficial by 68% of students, supporting Johnson and Johnson (2017), who demonstrated a 20% improvement in mathematics performance through cooperative learning. Additionally, Mutua (2022) in Kitui observed a 10% improvement in mathematics scores due to peer teaching and group work. This study emphasizes the motivational and social benefits of group learning in rural classrooms, where collaboration often compensates for resource limitations.

Classroom discussions were highlighted as influential by 70% of students. This finding aligns with Hattie (2012), who linked discussions to a 17% improvement in mathematics performance. Discussions enable students to articulate their understanding and clarify doubts through peer and teacher interactions. However, in Kitui, large class sizes often hinder the effective facilitation of discussions, presenting a challenge unique to this context.

These findings affirm that active engagement strategies significantly enhance mathematics performance. However, their effectiveness in Kitui depends on addressing resource and training gaps. Schools should promote a culture of collaboration, hands-on learning, and active questioning while empowering teachers to implement these strategies effectively.

4.5.2 Use of Formative Assessments and Mathematics Performance

Figure 4.5 presents data on the influence of various formative assessment practices on mathematics performance in Kitui Rural Sub-County. Formative assessments, which include activities such as quizzes, feedback, and modifying lessons based on assessment results, are essential for identifying learning gaps and enhancing student understanding. According to research, effective formative assessment helps teachers adjust instruction to meet students' needs, thus improving performance. Sahlberg (2019) in Finland found that students who received frequent feedback performed 25% better in mathematics. This section discusses the findings on formative assessment practices and integrates them with relevant literature.

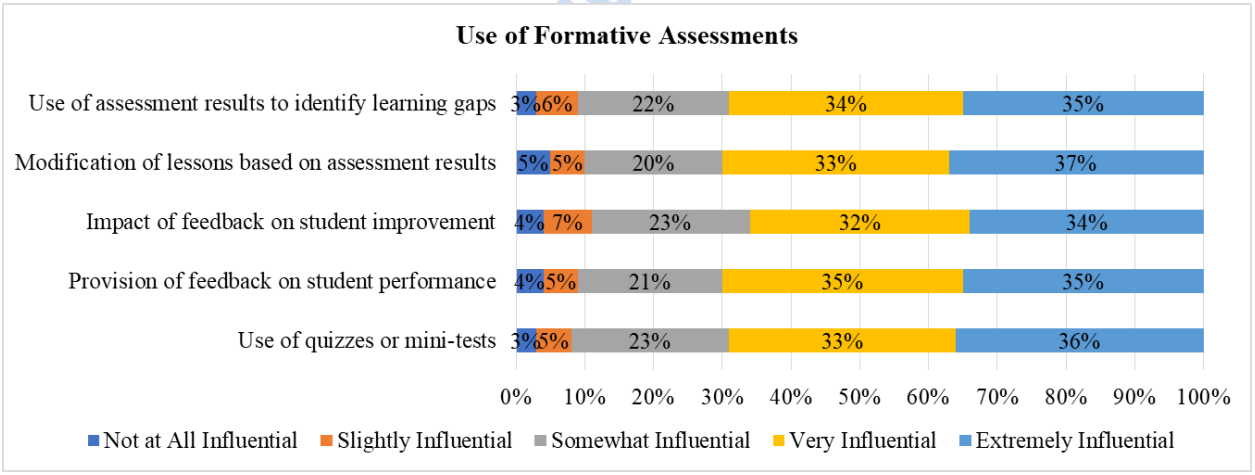

Figure 4. 5: Use of Formative Assessments and Mathematics Performance

The data shows that 69% of students recognized identifying learning gaps as highly influential. This finding aligns with Sahlberg (2019) in Finland, where early interventions improved mathematics outcomes by 25%. Identifying gaps enables teachers to address misconceptions before they escalate, making it a crucial strategy for improving performance.

Lesson modification based on assessment outcomes was valued by 70% of students, supporting Tan and Goh (2021) in Singapore, who observed a 20% improvement in mathematics performance when teaching was tailored to students' needs. In Kitui, however, this study highlights the additional challenge of limited resources, which may hinder teachers from effectively modifying lessons to accommodate diverse learning needs.

Feedback emerged as another critical component, with 66% of students emphasizing its role in enhancing understanding. This aligns with Amoako (2020), who found that consistent feedback improved mathematics performance by 20% in Ghana. Feedback provides students with actionable guidance, enabling them to reflect on their progress and take corrective action. However, in Kitui, feedback practices are often hindered by high teacher-student ratios.

Quizzes and mini-tests were highlighted as effective tools for monitoring progress, with 69% of students valuing them highly. Olaniyan and Okemakinde (2018) similarly emphasized the role of frequent quizzes in reinforcing learning and retention. This study underscores the motivational aspect of quizzes, as they help students build confidence through regular practice.

These findings demonstrate the alignment of formative assessments with Constructivist Learning Theory, which emphasizes continuous reflection and adjustment in teaching. Teachers in Kitui should be supported in integrating these practices through professional development and access to assessment tools.

4.5.3 Diversity of Instructional Methods Employed and Mathematics Performance

Figure 4.6 highlights the influence of various instructional methods on mathematics performance in Kitui Rural Sub-County. These methods include variations for different learning styles, inquiry-based learning, the use of technology, real-life applications, and collaborative learning. Effective teaching requires flexibility and adaptability to cater to diverse student needs and preferences. Constructivist Learning Theory (Vygotsky, 1978) supports using multiple instructional methods to

help students build knowledge through different experiences. This section discusses the findings and integrates relevant literature to emphasize the importance of diverse instructional methods in improving mathematics outcomes.

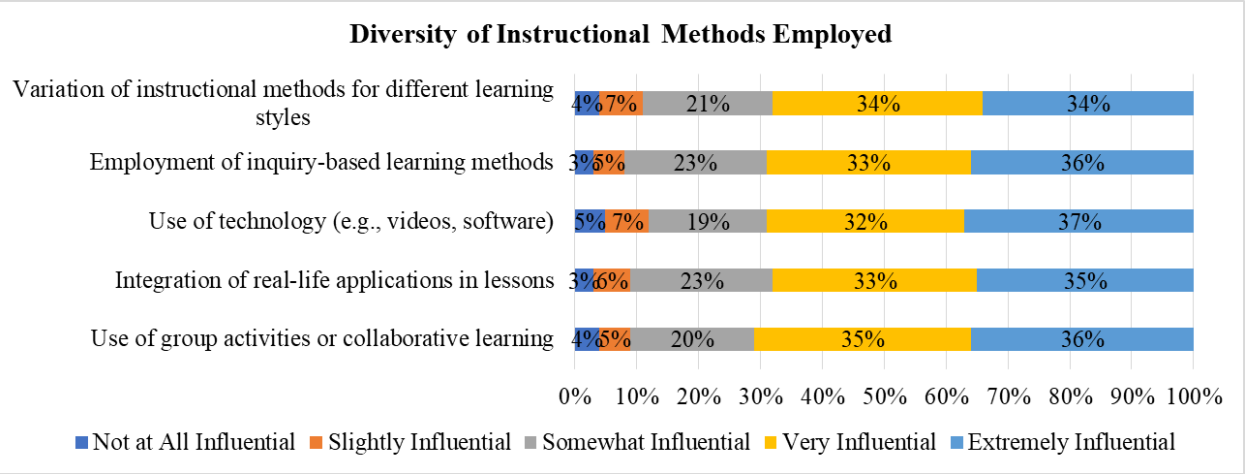

Figure 4. 6: Diversity of Instructional Methods Employed and Mathematics Performance

The study found that 68% of students recognized the importance of tailoring teaching methods to different learning styles. This result is consistent with Tomlinson (2014), who emphasized the significance of differentiated instruction in addressing the unique needs of visual, auditory, and kinesthetic learners. Differentiated instruction ensures inclusivity, particularly in diverse classrooms like those in Kitui, where students often come from varied educational and socio-economic backgrounds. However, unlike urban-focused studies, this research highlights challenges in rural areas, such as insufficient teacher training on implementing differentiated approaches effectively.

Inquiry-based learning was highly valued, with 69% of students rating it as very or extremely influential. This finding aligns with Prince and Felder (2006), who linked inquiry-based methods to improved critical thinking and problem-solving skills. Mwangi and Njagi (2019) in Kenya similarly observed a 15% improvement in mathematics scores through this approach. Inquiry-based learning encourages students to actively explore concepts and solve problems independently or collaboratively, fostering deeper understanding. However, in Kitui, limited access to resources, such

as laboratory equipment or manipulatives, can impede the full implementation of this method, a challenge less emphasized in studies conducted in resource-rich contexts.

The integration of technology in teaching was another influential factor, with 69% of students recognizing its impact on their learning. Technology aids in visualizing abstract mathematical concepts, making them more accessible and engaging. This result supports Mishra and Koehler (2006), who highlighted the role of technology in improving comprehension and student motivation. In Kitui, however, the lack of adequate technological infrastructure, such as computers and internet connectivity, restricts the potential benefits of technology in classrooms. While technology integration is a proven strategy globally, this study underscores the pressing need for infrastructural investments to level the playing field for rural schools.

Real-life applications were also identified as a crucial instructional method, with 68% of students acknowledging their relevance in making mathematics meaningful and relatable. This finding is consistent with Boaler (2016), who argued that applying mathematics to real-world problems enhances retention and engagement. For instance, in Kitui, using examples related to farming or small-scale businesses can help students connect abstract concepts like percentages or ratios to their daily experiences. However, this approach requires teachers to be creative and resourceful, often designing their instructional materials to suit local contexts.

Collaborative learning emerged as the most impactful instructional method, with 71% of students rating it highly. This finding aligns with Johnson and Johnson (2017), who demonstrated the effectiveness of cooperative learning in fostering teamwork and shared responsibility. Collaborative activities, such as peer teaching and group problem-solving, allow students to learn from one another, clarify misconceptions, and build communication skills. In Kitui, Mutua (2022) found a 10% improvement in mathematics performance through peer teaching. However, the effectiveness

of collaboration in large or overcrowded classrooms, a common issue in Kitui, may be diminished due to logistical challenges.

The findings on the diversity of instructional methods highlight their alignment with Constructivist Learning Theory, which advocates for student-centered approaches that accommodate various learning styles and experiences. By employing diverse methods, teachers can address individual differences, enhance engagement, and improve overall mathematics performance.

4.6 To Evaluate the Influence of Instructional Materials on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County

Instructional materials play a critical role in the teaching and learning of mathematics. The availability, quality, and effective utilization of these materials can significantly impact student performance. Instructional materials such as textbooks, digital resources, visual aids, and teaching aids provide the necessary support for conceptual understanding and skill development. According to Mwangi and Njagi (2019), schools that ensure the availability of adequate instructional materials experience better academic outcomes. This section explores how the availability, quality, and utilization of instructional materials influence mathematics performance in Kitui Rural Sub-County, highlighting their role in improving KCSE results.

4.6.1 Availability of Instructional Materials and Mathematics Performance

Figure 4.7 presents data on the influence of various aspects of instructional material availability on mathematics performance in Kitui Rural Sub-County. Instructional materials such as textbooks, digital resources, and teaching aids are essential for facilitating effective learning. The timely availability and variety of these resources ensure that students can engage deeply with mathematical concepts. According to Mwangi and Njagi (2019), schools with sufficient instructional resources experience better academic outcomes. This section discusses the findings on the availability of instructional materials and integrates insights from relevant literature.

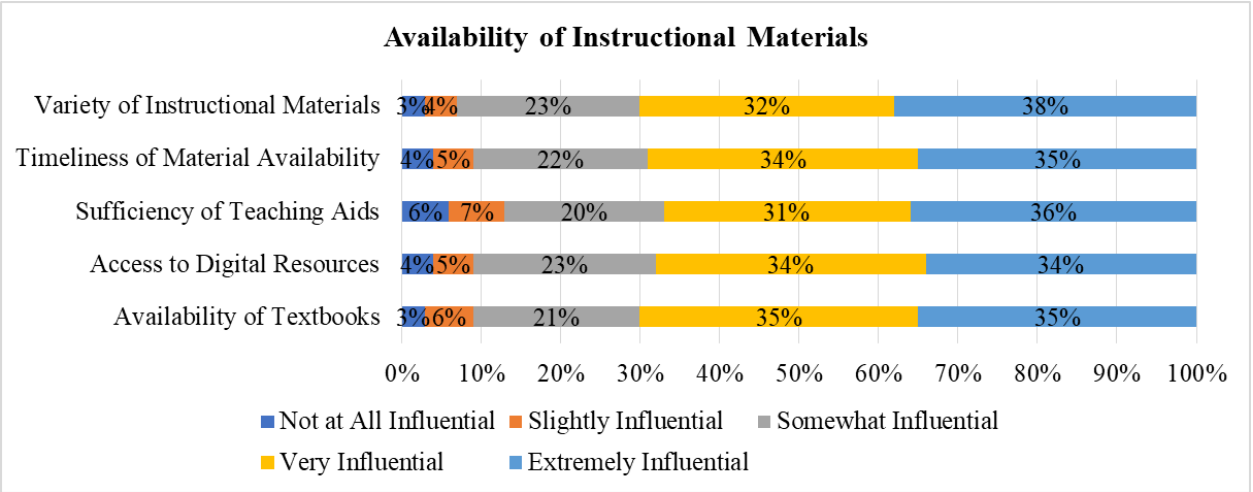

Figure 4. 7: Availability of Instructional Materials and Mathematics Performance

The study results show that 70% of students reported that a variety of instructional materials significantly influenced their performance in mathematics. This finding aligns with Tomlinson (2014), who highlighted the importance of diverse resources in catering to different learning styles. A variety of materials, including textbooks, charts, and digital content, enables differentiated instruction, ensuring inclusivity in learning. In Kitui, where resources are limited, enhancing the variety of instructional materials can bridge gaps in engagement and comprehension.

The study results also reveal that 69% of students emphasized the importance of timely availability of materials. Sahlberg (2019) noted that delays in providing resources hinder lesson planning and disrupt the learning process. In Kitui Rural Sub-County, where logistical challenges often delay the delivery of resources, addressing this issue could improve lesson continuity and student performance.

Teaching aids, such as models and manipulatives, were reported as influential by 67% of students. Boaler (2016) argued that these aids make abstract mathematical concepts more tangible, fostering deeper understanding. However, in Kitui, the shortage of teaching aids limits teachers' ability to use hands-on learning strategies, negatively affecting students' ability to grasp complex topics.

Digital resources were also recognized as impactful, with 68% of students acknowledging their value. Mishra and Koehler (2006) emphasized that digital tools enhance engagement and comprehension, particularly for abstract subjects like mathematics. However, infrastructural challenges such as inadequate electricity and internet connectivity in Kitui hinder the effective use of digital resources, creating disparities in access.

Textbooks emerged as the most influential resource, with 70% of students highlighting their importance. Nyabero (2020) reported that access to sufficient textbooks improved student performance by 20%. In Kitui, ensuring that every student has access to relevant, up-to-date textbooks remains a pressing need. Addressing shortages and outdated materials can significantly enhance learning outcomes.

The study results emphasize the need for timely, adequate, and diverse instructional materials in Kitui Rural Sub-County. Policymakers and school administrators should prioritize the procurement and equitable distribution of textbooks, teaching aids, and digital resources. Investments in infrastructure to support digital learning are also critical for addressing disparities in resource availability.

4.6.2 Quality of Instructional Materials and Mathematics Performance

Figure 4.8 presents data on the influence of various aspects of instructional material quality on mathematics performance in Kitui Rural Sub-County. The quality of instructional materials, including clarity, relevance, alignment with curriculum standards, and the effectiveness of visual aids, plays a significant role in enhancing students' understanding and performance. High-quality materials ensure that students receive accurate, clear, and relevant information to aid in their learning process. According to Nyabero (2020), schools that utilize well-structured and up-to-date materials experience better academic outcomes. This section discusses the findings and integrates

relevant literature to highlight the importance of quality instructional materials in improving KCSE mathematics results.

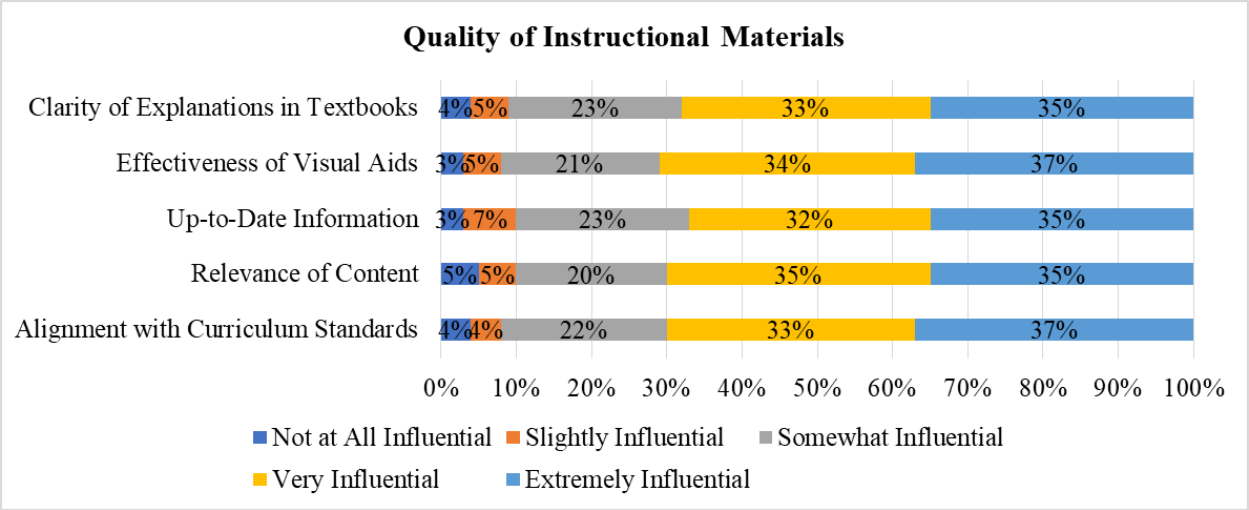

Figure 4. 8: Quality of Instructional Materials and Mathematics Performance

The study results show that 68% of students reported the clarity of instructional materials as highly influential. Nyabero (2020) emphasized that clear explanations in textbooks improve comprehension and problem-solving abilities. This finding suggests that textbooks and resources used in Kitui schools should provide step-by-step instructions and illustrative examples to simplify complex concepts.

Visual aids were reported as crucial, with 71% of students emphasizing their importance in understanding mathematics. Boaler (2016) argued that effective visual aids make learning accessible, particularly for visual learners. In Kitui, incorporating diagrams, charts, and illustrations in teaching materials can significantly enhance students' ability to grasp mathematical concepts.

The relevance of content was rated highly by 70% of students. According to Tomlinson (2014), relevant materials engage students by connecting academic concepts to real-world applications. In Kitui, aligning content with students' lived experiences—such as agricultural and business contexts—can make mathematics more relatable and engaging.

Curriculum alignment was also noted as a critical factor, with 70% of students acknowledging its influence. Hattie (2009) emphasized that materials aligned with curriculum standards ensure that students are adequately prepared for examinations. In Kitui, ensuring that textbooks and teaching aids cover all KCSE requirements can improve student readiness and performance.

Implications: Improving the quality of instructional materials in Kitui requires a focus on clarity, relevance, and alignment with the curriculum. Schools should prioritize the acquisition of materials that meet these criteria and invest in professional development to guide teachers in effectively utilizing high-quality resources.

4.6.3 Utilization of Instructional Materials and Mathematics Performance

Figure 4.9 presents data on the influence of how instructional materials are utilized in teaching mathematics in Kitui Rural Sub-County. Effective utilization of materials, including textbooks, digital resources, and instructional aids, plays a crucial role in enhancing student engagement, understanding, and performance. Teachers' skills in using these materials and the frequency of their use in class determine how well students grasp mathematical concepts. According to Mishra and Koehler (2006), effective integration of instructional materials enhances comprehension and student motivation. This section discusses the findings on the utilization of instructional materials and relates them to relevant literature.

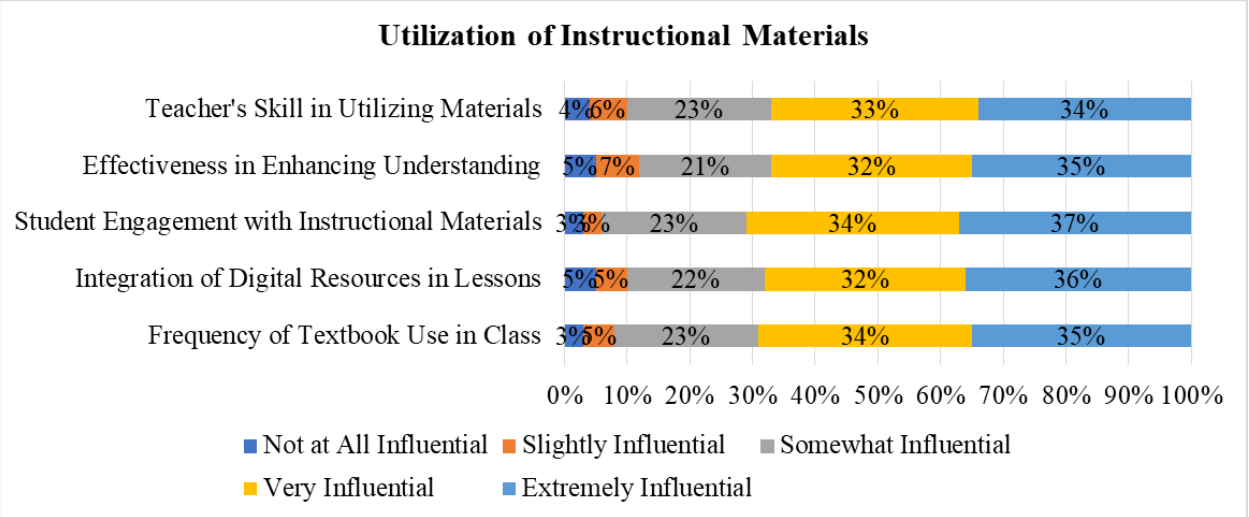

Figure 4. 9: Utilization of Instructional Materials and Mathematics Performance

Teachers' proficiency in utilizing materials was reported as highly influential by 67% of students. Nyabero (2020) emphasized that teacher training enhances the effective use of instructional materials, improving student comprehension. In Kitui, professional development programs should equip teachers with the skills to integrate textbooks, digital tools, and teaching aids seamlessly into their lessons.

Student engagement with instructional materials was rated highly by 71% of students. Tomlinson (2014) noted that interactive resources keep students motivated and improve retention. In Kitui, fostering active student participation through engaging materials can address persistent challenges in mathematics performance.

Digital tools were also reported as significant, with 68% of students highlighting their value. Mishra and Koehler (2006) found that integrating technology into lessons improved student outcomes by 20%. However, the limited availability of digital resources in Kitui restricts their potential benefits, necessitating investments in technological infrastructure.

Regular use of textbooks was reported as highly influential by 69% of students. Mwangi and Njagi (2019) reported that consistent textbook use improves retention and exam performance. Ensuring that textbooks are used effectively in Kitui schools can provide students with the structure and consistency needed for academic success.

Enhancing the utilization of instructional materials in Kitui requires targeted investments in teacher training and infrastructure. Schools should encourage the consistent use of textbooks and provide resources to support interactive learning. Policymakers must address challenges in technological access to maximize the benefits of digital tools in classrooms.

4.7 To Analyze the Influence of the Classroom Environment on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County

The classroom environment plays a critical role in shaping students' learning experiences and academic outcomes in mathematics. Both the physical environment (such as classroom space, furniture, and lighting) and the psychosocial environment (including student-teacher interactions, discipline, and peer collaboration) can significantly impact performance. A positive and supportive learning environment enhances student engagement, motivation, and comprehension. According to Hattie (2009), conducive classroom environments contribute to better academic performance by fostering a sense of safety, respect, and collaboration. This section explores how various aspects of the classroom environment influence mathematics performance in Kitui Rural Sub-County, highlighting their importance in improving KCSE outcomes.

4.7.1 Physical Classroom Environment and Mathematics Performance

Figure 4.10 presents data on the influence of various physical classroom environment factors on mathematics performance in Kitui Rural Sub-County. These factors include the availability of teaching equipment, classroom space, condition of furniture, cleanliness, and ventilation. A well-maintained and adequately equipped classroom creates a conducive learning environment, fostering student engagement and comprehension. According to Fraser (2012), the physical environment directly impacts students' ability to focus and learn effectively. This section discusses the findings and integrates them with relevant literature to highlight the importance of the physical classroom environment in improving KCSE mathematics results.

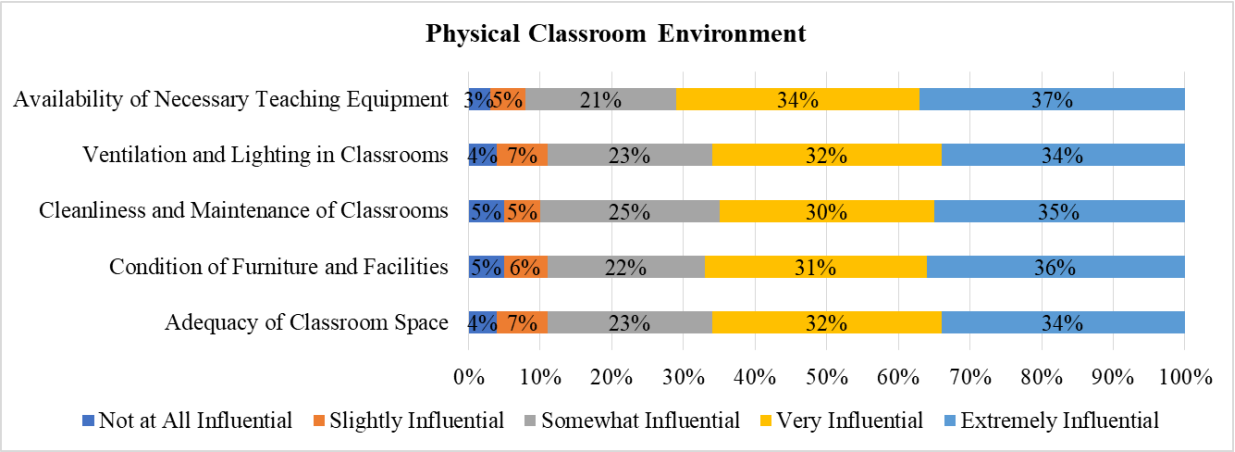

Figure 4. 10: Physical Classroom Environment and Mathematics Performance

The study results show that 71% of students considered the availability of teaching equipment, such as whiteboards, projectors, and mathematical instruments, highly influential in enhancing mathematics performance. This aligns with Boaler (2016), who noted that access to appropriate teaching tools enhances instructional delivery and conceptual understanding. In Kitui Rural Sub-County, addressing gaps in teaching equipment availability could significantly improve learning outcomes.

Ventilation and lighting were rated as critical by 66% of students. Proper ventilation and adequate lighting reduce distractions and fatigue, creating an optimal learning environment. Barrett et al. (2015) reported that well-lit and ventilated classrooms improved academic performance by 16%. Schools in Kitui Rural Sub-County should prioritize these aspects to enhance focus and engagement.

Cleanliness and maintenance were highlighted by 65% of students as influencing their mathematics performance. A tidy and well-maintained classroom fosters discipline and respect for the learning space, as noted by Fraser (2012). Addressing cleanliness challenges in Kitui schools could reduce health-related disruptions and create a more positive learning environment.

The condition of furniture was also significant, with 67% of students emphasizing its impact on their learning experience. Comfortable and ergonomic furniture supports proper posture, reducing

physical discomfort that might hinder concentration. Barrett et al. (2015) emphasized that modern furniture enhances student focus, underscoring the need for better infrastructure in Kitui classrooms.

Classroom space was rated highly influential by 66% of students. Adequate space allows for movement, group activities, and effective teacher-student interaction. Overcrowding, as observed in many Kitui schools, limits these interactions and creates distractions. Mutua (2022) reported a 12% improvement in mathematics performance in schools with adequate classroom space.

Improving the physical classroom environment in Kitui Rural Sub-County requires investments in infrastructure, teaching equipment, and maintenance. Policymakers should address overcrowding, ensure regular maintenance, and provide modern, ergonomic furniture. Creating well-ventilated, clean, and adequately equipped classrooms will enhance focus, engagement, and overall mathematics performance.

4.7.2 Psychosocial Classroom Environment and Mathematics Performance

Figure 4.11 presents data on the influence of the psychosocial classroom environment on mathematics performance in Kitui Rural Sub-County. The psychosocial environment includes factors such as student-teacher interactions, peer relationships, classroom discipline, and a supportive atmosphere. A positive psychosocial environment fosters motivation, confidence, and a sense of belonging, which are critical for academic success. According to Hattie (2009), a supportive learning environment can lead to a 17% improvement in student performance. This section discusses the findings and integrates relevant literature to highlight the importance of the psychosocial classroom environment in improving mathematics outcomes.

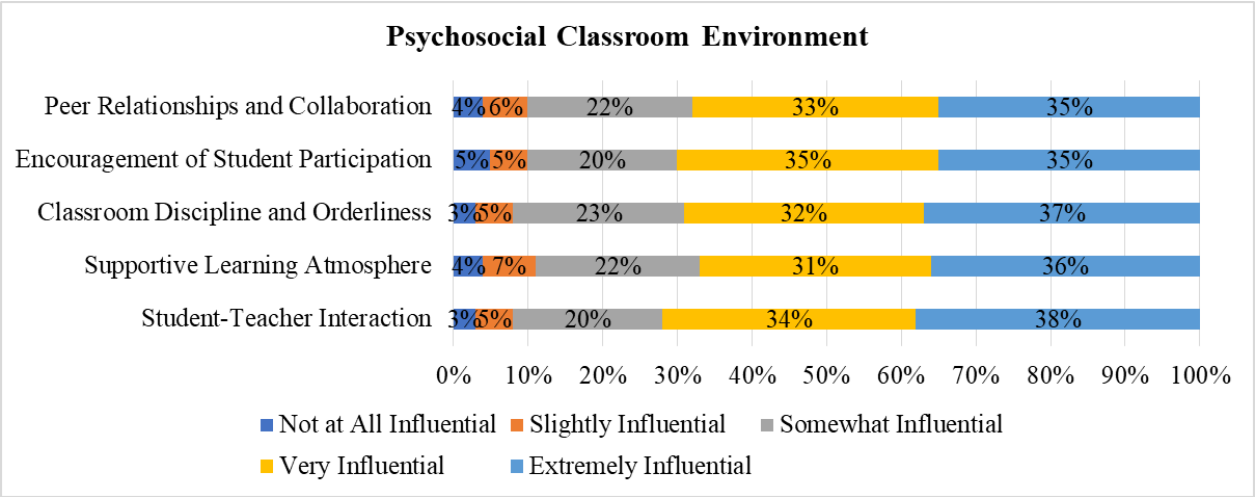

Figure 4. 11: Psychosocial Classroom Environment and Mathematics Performance

The study results indicate that 68% of students highlighted peer relationships and collaboration as critical. Collaborative learning fosters knowledge sharing and problem-solving, consistent with Johnson and Johnson (2017), who reported a 20% improvement in academic performance through cooperative learning. Encouraging group activities in Kitui Rural Sub-County could enhance peer support and confidence.

Encouragement of participation was rated as highly influential by 70% of students. Active participation enables students to develop problem-solving skills and a deeper understanding of mathematical concepts. Hattie (2009) noted that active engagement leads to improved academic outcomes. Teachers in Kitui should create inclusive classrooms that motivate all students to participate actively.

Classroom discipline was emphasized by 69% of students as vital for minimizing disruptions and maintaining focus. Fraser (2012) observed that well-managed classrooms improve academic performance by fostering a structured learning environment. In Kitui, ensuring proper classroom management can enhance student attentiveness and performance.

A supportive classroom atmosphere was considered significant by 67% of students. Feeling respected and valued boosts students' confidence and willingness to learn. Tomlinson (2014)

highlighted the importance of supportive environments in promoting engagement and achievement. Teachers in Kitui should focus on building trust and creating a welcoming atmosphere.

Student-teacher interaction emerged as the most influential factor, with 72% of students emphasizing its importance. Effective interactions involve trust, clarity, and personalized feedback, which enhance understanding and motivation. Hattie (2012) reported a 17% improvement in performance when student-teacher relationships were positive. Teachers in Kitui should prioritize building strong connections with their students.

Schools in Kitui Rural Sub-County should promote a culture of respect, collaboration, and discipline in classrooms. Professional development for teachers should focus on fostering positive student-teacher interactions and creating inclusive, supportive environments. These efforts can motivate students and improve mathematics performance.

4.7.3 Learning Climate and Atmosphere and Mathematics Performance

Figure 4.12 presents data on the influence of the learning climate and atmosphere on mathematics performance in Kitui Rural Sub-County. Factors such as encouraging problem-solving, creating a supportive environment, allowing expression of opinions, reinforcing positive behavior, and motivating students play a significant role in shaping academic outcomes. A positive learning climate enhances student engagement, confidence, and critical thinking skills. According to Hattie (2009), a supportive and stimulating classroom environment can improve student performance by fostering active participation and a growth mindset. This section discusses the findings and integrates them with relevant literature to highlight the importance of the learning climate and atmosphere in improving KCSE mathematics results.

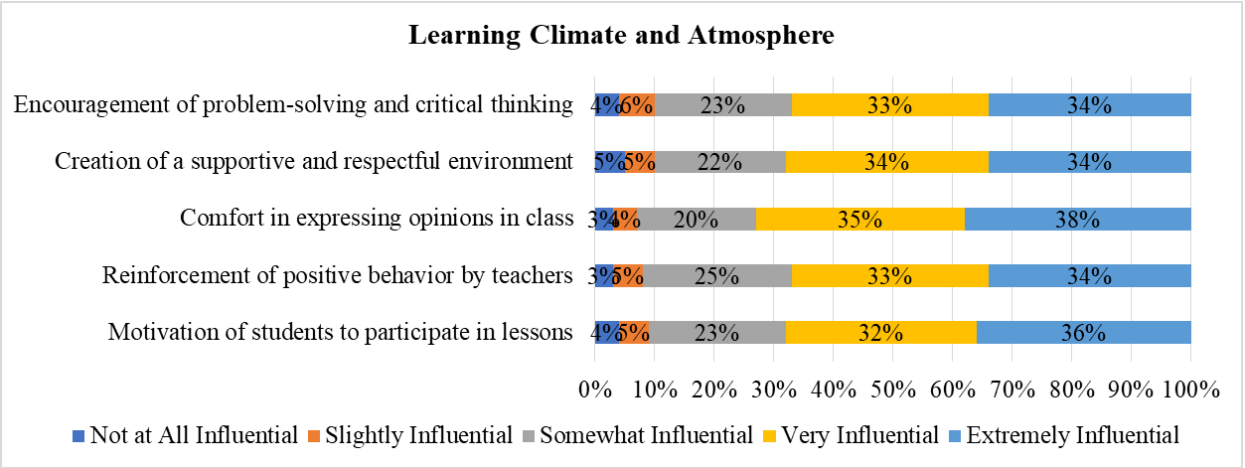

Figure 4. 12: Learning Climate and Atmosphere and Mathematics Performance

The study results show that 67% of students rated the encouragement of problem-solving as highly influential. Classrooms that promote critical thinking improve analytical skills and help students tackle complex mathematical problems, consistent with Boaler (2016). Encouraging problem-solving in Kitui can address persistent challenges in mathematics performance.

A supportive and respectful environment was emphasized by 68% of students as critical. Respect fosters inclusivity and boosts participation, as highlighted by Tomlinson (2014). Teachers in Kitui should prioritize cultivating respect and fostering positive interactions to improve engagement.

Comfort in expressing opinions was reported as highly influential by 73% of students. Open communication encourages students to ask questions and clarify doubts, enhancing comprehension. Hattie (2009) noted that open classroom discussions improve understanding and retention of concepts. Encouraging students to express themselves freely can boost their confidence and academic performance.

Reinforcement of positive behavior was significant, with 67% of students highlighting its importance. Recognizing effort and achievements fosters motivation and a growth mindset, as emphasized by Dweck (2006). Teachers in Kitui should consistently reinforce positive behavior to maintain a productive learning atmosphere.

Motivation to participate was noted as critical by 68% of students. Motivated students are more likely to engage actively and persist through challenges. Ryan and Deci (2000) linked intrinsic motivation to improved academic outcomes. Teachers should create engaging lessons that inspire students to participate.

Improving the learning climate in Kitui requires fostering critical thinking, respect, and open communication. Schools should adopt practices that reinforce positive behavior and motivate students. These efforts can create a stimulating and supportive atmosphere, enabling students to excel in mathematics.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The chapters present summary, conclusions and the recommendations of the study guided by the objectives of the study.

5.2 Summary

5.2.1 To Examine the Influence of Instructional Leadership Practices on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County

The examination of instructional leadership practices and their influence on mathematics performance in Kitui Rural Sub-County highlights three crucial components: teacher professional development, classroom supervision and support, and resource allocation. These leadership practices play a significant role in shaping instructional quality and student outcomes.

For teacher professional development, the findings indicate that regular workshops, in-service training, and knowledge-sharing sessions significantly impact teaching effectiveness. About 67-69% of respondents found these practices very or extremely influential. Teachers who receive continuous professional development gain confidence, stay updated with modern teaching techniques, and improve their instructional delivery. These findings align with research by Leithwood et al. (2020) and Desimone (2009), which emphasize that ongoing professional development enhances teacher efficacy and student achievement.

In terms of classroom supervision and support, the data reveals that monitoring progress, providing constructive feedback, and offering instructional support are critical for improving teaching practices. Approximately 66-70% of respondents rated these practices as very or extremely influential. Effective supervision ensures accountability and continuous improvement in

instructional quality. Research by Sergiovanni and Starratt (2007) and Hattie (2009) supports the role of supervision and feedback in enhancing teaching effectiveness and student performance.

For resource allocation, the availability of textbooks, digital tools, teaching aids, and financial support was highlighted as essential for effective mathematics instruction. About 64-72% of respondents found these resources very or extremely influential. Adequate resources facilitate hands-on learning, remedial support, and engagement with digital content. Studies by Nyabero (2020) and Boaler (2016) affirm that sufficient resource allocation improves student engagement, comprehension, and academic performance.

5.2.2 To Assess the Influence of Instructional Strategies on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County

The findings on instructional strategies and their influence on mathematics performance in KCSE in public secondary schools in Kitui Rural Sub-County reveal the importance of effective teaching practices. Three key aspects were explored: student engagement levels, the use of formative assessments, and the diversity of instructional methods.

In terms of student engagement, the data shows that activities such as hands-on learning, asking questions, solving challenging problems, group work, and classroom discussions are highly influential in improving performance. About 70% of students rated these activities as either very or extremely influential. The findings align with Constructivist Learning Theory (Piaget, 1954; Vygotsky, 1978), which emphasizes that students learn best through active participation and collaborative experiences. Research by Olaniyan and Okemakinde (2018) and Hattie (2012) supports the idea that active learning strategies lead to improved comprehension and problem-solving abilities.

The analysis of formative assessments highlights the critical role of continuous evaluation in mathematics performance. Practices such as identifying learning gaps, modifying lessons based on assessments, and providing regular feedback were rated as very or extremely influential by 66-70%

of students. This finding aligns with research by Sahlberg (2019) and Tan and Goh (2021), which indicates that formative assessments help teachers tailor their instruction to student needs, resulting in better academic outcomes. Effective feedback and timely interventions ensure that students receive the support necessary to improve their performance.

The findings on the diversity of instructional methods show that adopting varied teaching strategies caters to different learning needs and enhances performance. Methods such as inquiry-based learning, the use of technology, real-life applications, and collaborative learning were deemed very or extremely influential by 68-71% of students. These results support Tomlinson's (2014) view that differentiated instruction improves engagement and performance. Research by Prince and Felder (2006) highlights the importance of inquiry-based learning in developing critical thinking skills, while Johnson and Johnson (2017) emphasize the benefits of cooperative learning in enhancing student achievement.

5.2.3 To Evaluate the Influence of Instructional Materials on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County

The evaluation of instructional materials and their influence on mathematics performance in Kitui Rural Sub-County revealed three critical aspects: the availability, quality, and utilization of instructional materials. These aspects play a significant role in enhancing students' engagement, comprehension, and overall academic outcomes in KCSE mathematics.

In terms of availability of instructional materials, the findings indicate that access to a variety of resources such as textbooks, digital resources, and teaching aids is highly influential. About 70% of students found the availability of textbooks and the diversity of instructional materials to be very or extremely influential. Additionally, the timeliness of material availability was rated highly by 69% of students. These findings align with research by Mwangi and Njagi (2019) and Tomlinson (2014), which highlight the importance of providing timely and diverse instructional resources to cater to different learning needs.

Regarding the quality of instructional materials, clarity, relevance, and alignment with curriculum standards were deemed critical by students. About 68-71% of students rated these factors as very or extremely influential. Clear explanations in textbooks, effective visual aids, up-to-date information, and curriculum-aligned content significantly enhance student understanding. Research by Nyabero (2020) and Boaler (2016) supports these findings, emphasizing that high-quality materials lead to better comprehension and problem-solving skills.

For the utilization of instructional materials, teacher proficiency, student engagement with materials, and the integration of digital tools were highlighted as key factors. About 67-71% of students acknowledged the importance of these practices in improving performance. Effective use of materials, such as textbooks, digital resources, and visual aids, enhances student motivation and understanding. This is supported by Mishra and Koehler (2006) and Tomlinson (2014), who found that well-utilized instructional materials significantly improve learning outcomes.

5.2.4 To Analyze the Influence of the Classroom Environment on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County

The analysis of the classroom environment and its influence on mathematics performance in Kitui Rural Sub-County revealed three key dimensions: the physical environment, the psychosocial environment, and the learning climate and atmosphere. These aspects significantly impact student engagement, comprehension, and overall academic achievement in KCSE mathematics.

Regarding the physical classroom environment, factors such as the availability of teaching equipment, ventilation, cleanliness, furniture condition, and classroom space were highlighted. About 66-71% of students found these factors very or extremely influential. For instance, 37% rated the availability of teaching equipment as extremely influential, while 34% highlighted the importance of adequate classroom space. Research by Boaler (2016) and Fraser (2012) confirms that well-equipped, clean, and spacious classrooms improve focus, reduce distractions, and enhance learning outcomes.

The psychosocial classroom environment was also shown to be crucial for mathematics performance. Factors such as student-teacher interactions, peer relationships, classroom discipline, and a supportive atmosphere were rated very or extremely influential by 67-72% of students. Effective student-teacher interactions were rated highly by 72% of students, while classroom discipline was recognized by 69%. Studies by Hattie (2009) and Johnson and Johnson (2017) support the idea that positive relationships, discipline, and a supportive environment lead to improved motivation, engagement, and academic outcomes.

The findings on the learning climate and atmosphere emphasized the importance of fostering problem-solving skills, creating a supportive environment, encouraging expression of opinions, reinforcing positive behavior, and motivating students. Between 67-73% of students found these aspects very or extremely influential. For instance, 73% of students rated the comfort in expressing opinions as critical to their learning. Literature by Boaler (2016) and Tomlinson (2014) highlights that a positive learning climate encourages active participation, critical thinking, and confidence, leading to better mathematics performance.

5.3 Conclusions

5.3.1 To Examine the Influence of Instructional Leadership Practices on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County

Instructional leadership practices are pivotal in improving mathematics performance in Kitui Rural Sub-County. Regular professional development equips teachers with modern instructional strategies and enhances their confidence. Effective classroom supervision, including progress monitoring and constructive feedback, fosters continuous improvement in teaching practices. Additionally, adequate resource allocation, such as textbooks, teaching aids, and digital tools, supports effective instruction and student engagement.

These findings align with research by Leithwood et al. (2020), Desimone (2009), and Nyabero (2020), which emphasize the importance of instructional leadership in creating a supportive teaching environment and achieving better student outcomes. Strengthening instructional leadership practices can address persistent challenges in mathematics performance and lead to improved KCSE results.

5.3.2 To Assess the Influence of Instructional Strategies on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County

The findings underscore that effective instructional strategies are pivotal in improving mathematics performance in Kitui Rural Sub-County. Active student engagement, the strategic use of formative assessments, and the adoption of diverse instructional methods align with Constructivist Learning Theory and contemporary research. When students actively participate, receive timely feedback, and experience varied teaching approaches, their understanding and problem-solving abilities are significantly enhanced. Addressing the persistent challenges in mathematics performance requires a classroom culture that promotes questioning, collaboration, and hands-on learning. Additionally, instructional leadership and adequate resource allocation are necessary to support these strategies and ensure their successful implementation.

5.3.3To Evaluate the Influence of Instructional Materials on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County

The findings demonstrate that instructional materials are pivotal in enhancing mathematics performance in Kitui Rural Sub-County. The availability of diverse and timely instructional resources ensures that students have the tools they need to engage effectively with mathematical concepts. High-quality instructional materials, characterized by clarity, relevance, and alignment with curriculum standards, enhance student comprehension and problem-solving skills. Additionally, the effective utilization of these materials by teachers, including the use of digital tools and teaching aids, fosters better engagement and understanding.

These findings are supported by studies such as those by Mwangi and Njagi (2019), Tomlinson (2014), and Boaler (2016), which emphasize the role of instructional resources in improving academic outcomes. Addressing challenges related to resource availability, quality, and utilization can significantly improve KCSE mathematics performance in the region.

5.3.4 To Analyze the Influence of the Classroom Environment on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County

The findings underscore the critical role of the classroom environment in shaping mathematics performance in KCSE in Kitui Rural Sub-County. A conducive physical environment — characterized by adequate teaching equipment, proper lighting, cleanliness, and spacious classrooms — enhances focus, comfort, and engagement. The psychosocial environment, which includes supportive teacher-student interactions, peer collaboration, and classroom discipline, fosters motivation, confidence, and a sense of belonging. Furthermore, a positive learning climate and atmosphere that encourages problem-solving, respect, and active participation promotes critical thinking and persistence.

These findings are supported by research from Hattie (2009), Boaler (2016), and Fraser (2012), which show that both physical and psychosocial aspects of the classroom environment contribute to better academic outcomes. Addressing these factors can help overcome some of the challenges faced by students in Kitui Rural Sub-County, ultimately improving their mathematics performance.

5.4 Recommendations

5.4.1 To Examine the Influence of Instructional Leadership Practices on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County

Effective instructional leadership is crucial for fostering supportive environments that enable teachers to excel and improve students' mathematics performance. School leaders should actively promote continuous professional development opportunities, aligning with findings by Hallinger

(2020) that highlight the role of regular teacher training in improving mathematics outcomes. Implementing regular classroom observations and mentorship programs is also vital, as Ndirangu (2021) found that constructive feedback from administrators leads to measurable gains in student performance. Additionally, collaborative lesson planning sessions should be encouraged, fostering the sharing of innovative teaching techniques among mathematics teachers (Bush & Glover, 2019). These efforts not only strengthen teachers' instructional skills but also enhance their confidence in delivering engaging lessons.

Strategic resource allocation remains fundamental to effective instructional leadership. School administrators should prioritize the funding of instructional materials, teacher training workshops, and the acquisition of digital resources, reflecting recommendations by Darling-Hammond et al. (2019) on the need for equitable resource distribution. Building partnerships with governmental agencies, corporate sponsors, and NGOs can further supplement these efforts, ensuring that schools have the resources they need to foster quality mathematics education (MasterCard Foundation, 2021). Finally, fostering a data-driven culture—where student performance data informs instructional decisions—can help ensure that leadership practices are responsive and adaptive to students' needs (Creswell & Plano Clark, 2018).

5.4.2 To Assess the Influence of Instructional Strategies on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County

Adopting student-centered instructional strategies is essential to improving mathematics outcomes in public secondary schools. Educators should implement active learning approaches, such as problem-based learning and cooperative exercises, as these have been shown to increase mathematics performance by up to 20% (Johnson & Johnson, 2019; Sahlberg, 2020). Incorporating inquiry-based methods, as demonstrated in studies by Olaniyan and Okemakinde (2019), can deepen conceptual understanding and foster critical thinking skills. Differentiated instruction should also be emphasized to accommodate students' varied learning styles, aligning with research by

Makwinya and HakiElimu (2020) that shows tailored instruction can lead to improved engagement and performance.

Equally important is the integration of formative assessments to monitor student progress and inform teaching practices. Studies by Tan and Goh (2021) underscore the impact of regular quizzes and feedback sessions in boosting students' understanding of mathematical concepts. Encouraging peer-assisted learning—where students explain concepts to one another—can also enhance comprehension and foster a culture of collaborative problem-solving (Wanjiru, 2020). Ongoing professional development opportunities are critical to equipping teachers with the skills to effectively implement these interactive instructional strategies (Darling-Hammond, 2017).

5.4.3 To Evaluate the Influence of Instructional Materials on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County

Ensuring that high-quality instructional materials are readily available is critical for enhancing student achievement in mathematics. Schools should prioritize the provision of up-to-date textbooks, manipulatives, and digital resources, aligning with the OECD's (2020) recommendations on global standards for educational materials. Regularly updating these resources to reflect curriculum changes and evolving pedagogical practices is essential for maintaining relevance and effectiveness (Ahtola et al., 2019). Integrating digital learning tools—such as simulations and interactive exercises—can help bridge abstract concepts and real-world applications, improving student understanding (Goss & Sonnemann, 2020).

Beyond merely providing these materials, teachers must be trained to integrate them effectively into classroom instruction. As noted by Mwangi and Njagi (2019), teachers who use varied instructional resources see substantial improvements in student performance. Schools should also establish resource-sharing systems to promote collaboration and access to best practices, following the approach suggested by Amoako (2020). Partnerships with NGOs and government agencies can bolster these efforts, ensuring that all students, regardless of socioeconomic background, have equitable access to high-quality instructional materials (UNESCO, 2020).

5.4.4 To Analyze the Influence of the Classroom Environment on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County

Creating and maintaining a conducive physical classroom environment is essential for mathematics achievement. Classrooms should be well-lit, ventilated, and equipped with ergonomic furniture to enhance student focus and comfort, as supported by findings from Earthman (2019) and Adeyemi (2019). To address the persistent issue of overcrowding in rural schools, alternative strategies—such as rotational learning schedules and investment in new infrastructure—should be explored (MasterCard Foundation, 2021). Providing well-equipped mathematics laboratories and quiet study spaces can further support experiential learning and the application of mathematical concepts (Tanner, 2020).

Equally important is fostering a positive psychosocial environment. Teachers should promote inclusive classroom cultures that encourage participation and collaboration, reflecting findings by Hattie (2021) on the power of teacher-student relationships. Reinforcing positive behaviors and recognizing academic achievement can help build student motivation and confidence (Spaull, 2019). Mentorship programs and interactive teaching practices can further enhance students' engagement, creating a dynamic environment where mathematics learning thrives (Ngugi, 2019).

5.5 Recommendations for Further Research

To expand on the findings of this study and gain a deeper understanding of the factors shaping mathematics performance in rural Kenyan contexts, several avenues for future research are recommended. First, there is a need for longitudinal studies to explore the long-term effects of instructional strategies and leadership practices on mathematics outcomes. Such studies would provide critical insights into whether interventions like problem-based learning, continuous assessment, and mentorship lead to sustained improvements in student achievement over multiple years (Hallinger, 2020; Johnson & Johnson, 2019). This long-term perspective is essential for informing policies that seek to institutionalize effective practices in rural secondary schools.

Second, the integration of digital technologies in mathematics instruction remains an under-explored area, particularly in resource-constrained settings like Kitui Rural Sub-County. Research could investigate how access to and use of digital learning tools—such as interactive simulations and online practice exercises—affect mathematics engagement and performance (Goss & Sonnemann, 2020; MasterCard Foundation, 2021). Understanding how technology-enhanced learning can be adapted to rural classrooms would provide valuable guidance on bridging the digital divide and fostering more equitable learning environments.

Finally, gender differences in mathematics performance warrant closer investigation. Several studies, including Ndirangu (2021) and Mwangi and Njagi (2019), have hinted at nuanced variations in how instructional strategies and classroom environments impact male and female students. Exploring these dynamics could inform the development of targeted interventions that address gender disparities in mathematics performance and create more inclusive learning experiences. Additionally, investigating the role of socio-economic factors and home environments in shaping resource availability and instructional quality (UNESCO, 2020) would provide a more holistic understanding of the challenges facing rural secondary schools. This comprehensive perspective would enable educators, policymakers, and researchers to design interventions that address not only school-based factors but also the broader social and economic contexts that influence learning.

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APPENDICES

APPENDIX I: Introduction Letter

Mount Kenya University

DIRECTORATE OF GRADUATE STUDIES

MED/2021/76928

22nd November, 2024

National Commission for Science Technology & Innovation (NACOSTI)
Off Waiyaki, Upper Kabete
P.O Box 30623- 00100
NAIROBI, KENYA

Dear Sir/Madam,

RE: KEVIN ORINDO ONGARO- REGISTRATION NO. MED/2021/76928

The purpose of this letter is to introduce the above named student who is pursuing **Master of Education** in the **Department of Educational Management and Curriculum Studies** in the **School of Education.**

The title of the research is **"Influence of School - Based Curriculum Implementation Dynamics on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County Kitui County, Kenya."** It has been cleared by the University's Ethics Review Committee (Certificate attached) and now has to proceed to the field to collect data between **November, 2024 and January, 2025.**

Any assistance accorded to the student will be highly appreciated.

Thank you.

Mount Kenya University
P. O. Box 342 - 01000, THIKA
Office of the Director,
Graduate Studies

Dr. Samuel M. Karemba, Ph.D.
Director, Graduate Studies
Enc.

Main Campus, General Kago Road, P.O. Box 342-01000 Thika.
Cell: +254 709 153 000 / +254 709 162 000

Appendix II: Informed Consent

Informed Consent for Participants

We are a Research Team based at Mount Kenya University. We are conducting a study on "Influence of School-based curriculum implementation dynamics on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County, Kenya."

To achieve this, you have been selected to participate in the study. We kindly request you to agree to fully participate in the study.

The information you provide will be treated with confidentiality and used for the purpose of this study only. Please kindly endorse this consent form.

Statement	**Acceptance Tick**
I have read and understood the purpose of this project.	
I have been given the opportunity to ask questions about my participation and the project.	
I voluntarily agree to participate in the project.	
I have the freedom to withdraw from participation at any time without any repercussions.	
The procedure regarding confidentiality and anonymity has been clearly explained.	
The use of obtained data in research publication, sharing, and archiving has been clearly explained to me.	
I understand that other researchers can access the obtained data if they agree to preserve confidentiality.	
For the purpose of project recognition, I understand the data obtained will be used in reports, publications, and other research outputs.	
I agree together with the researcher to sign and date this informed consent form.	

Participant Signature: _____

Date: _____

Consent Form for Parents or Guardians

Dear Parent/Guardian,

We are a Research Team based at Mount Kenya University. We are conducting a study on "Influence of School-based curriculum implementation dynamics on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County, Kenya."

For this reason, we wish to inform you that we shall recruit your child as a participant in this study. This is only for research purposes. We will not use the information nor use your child for any other purposes. We will also seek permission from the school for that purpose. We will maintain privacy and confidentiality about the information. We will access the children through the school. Participation is totally voluntary and you may change your mind and withdraw your child at any time before and during the study. There will be no payment or incentives for this participation. If you want your child to take part in this research, please sign the form below. In case of any complaints, please contact:

The Director, Grants and Development
Mount Kenya University
P. O. Box 342-01000 Thika

Parent/Guardian:
Code of Parent/Guardian: ----------
Signature: ----------
Date: ----------

Assent Form for Minors

I have been informed that my parent(s) have given permission for me to participate if I want to in a study focusing on: "Influence of School-based curriculum implementation dynamics on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County, Kenya."

My participation in this project is voluntary and I have been told that I may stop my participation in this study at any time.

If I choose not to participate, it will not affect my grade/care in any way.

Code/Signature: ----------
Date: ----------

Appendix III: Questionnaire

Dear respondent,

My name is Kevin Orindo Ongaro, am studying at Mt. Kenya University. Am conducting a study titled 'Curriculum implementation dynamics on mathematics performance in public secondary schools in Kitui County. I hereby seek your participation as a class teacher on information that I believe will contribute significantly towards the study by filling this questionnaire. Kindly provide accurate and honest responses to the best of your knowledge on items highlighted. Any information given shall be accorded confidentiality and is only useful for the study purposes. Kindly provide your response to all items.

SECTION A:
Demographic Information

Tick appropriately

1) Gender: Male ( ) Female ( )

2) Age: below 25 ( ) 26-30 ( ) 31-40 ( ) 41-50 ( ) 51-60 ( )

3) Professional qualification: Doctorate ( ) Masters ( ) Bachelor degree ( ) Diploma ( ) Certificate ( )

4) Work experience Less than 2 years ( ); 4-8 ( ); 9-12 ( ); 14-16 ( ); over 17 years ( )

SECTION B:

W **Questionnaire**

Please indicate your level of agreement with each of the following statements by ticking the appropriate box:

Strongly Disagree [ ] Disagree [ ] Neutral [ ] Agree [ ] Strongly Agree [ ]

Objective 1: To examine the influence of instructional leadership practices on mathematics performance in KCSE in public secondary schools in Kitui Rural Sub-County, Kitui County.

Frequency of Teacher Professional Development Sessions

Factor	Not at All Influential	Slightly Influential	Somewhat Influential	Very Influential	Extremely Influential
Availability of in-service training opportunities	[]	[]	[]	[]	[]

Focus of professional development on mathematics teaching	[]	[]	[]	[]	[]
Encouragement to attend workshops or seminars	[]	[]	[]	[]	[]
Impact of professional development on teacher confidence	[]	[]	[]	[]	[]
Knowledge sharing among teachers after training sessions	[]	[]	[]	[]	[]

Classroom Supervision and Support

Factor	Not at All Influential	Slightly Influential	Somewhat Influential	Very Influential	Extremely Influential
Frequency of lesson observation by school heads	[]	[]	[]	[]	[]
Provision of constructive feedback to teachers	[]	[]	[]	[]	[]
Availability of instructional support for teachers	[]	[]	[]	[]	[]
Impact of supervision on teaching practices	[]	[]	[]	[]	[]
Monitoring progress in mathematics instruction	[]	[]	[]	[]	[]

Resource Allocation for Mathematics

Factor	Not at All Influential	Slightly Influential	Somewhat Influential	Very Influential	Extremely Influential
Availability of mathematics textbooks	[]	[]	[]	[]	[]
Access to digital resources for mathematics	[]	[]	[]	[]	[]
Provision of additional teaching aids	[]	[]	[]	[]	[]
Allocation of financial resources for mathematics	[]	[]	[]	[]	[]
Support for remedial mathematics programs	[]	[]	[]	[]	[]

Objective 2: To assess the influence of instructional strategies on mathematics performance in KCSE in public secondary schools in Kitui Rural Sub-County, Kitui County.

Student Engagement Levels

Factor	Not at All Influential	Slightly Influential	Somewhat Influential	Very Influential	Extremely Influential
Active participation in classroom discussions	[]	[]	[]	[]	[]
Engagement in group activities and collaborative tasks	[]	[]	[]	[]	[]
Interest in solving challenging mathematical problems	[]	[]	[]	[]	[]
Asking questions to clarify concepts	[]	[]	[]	[]	[]
Participation in hands-on learning activities	[]	[]	[]	[]	[]

Use of Formative Assessments

Factor	Not at All Influential	Slightly Influential	Somewhat Influential	Very Influential	Extremely Influential
Use of quizzes or mini-tests	[]	[]	[]	[]	[]
Provision of feedback on student performance	[]	[]	[]	[]	[]
Impact of feedback on student improvement	[]	[]	[]	[]	[]
Modification of lessons based on assessment results	[]	[]	[]	[]	[]
Use of assessment results to identify learning gaps	[]	[]	[]	[]	[]

Diversity of Instructional Methods Employed

Factor	Not at All Influential	Slightly Influential	Somewhat Influential	Very Influential	Extremely Influential

Use of group activities or collaborative learning	[]	[]	[]	[]	[]
Integration of real-life applications in lessons	[]	[]	[]	[]	[]
Use of technology (e.g., videos, software)	[]	[]	[]	[]	[]
Employment of inquiry-based learning methods	[]	[]	[]	[]	[]
Variation of instructional methods for different learning styles	[]	[]	[]	[]	[]

Objective 3: To evaluate the influence of instructional materials on mathematics performance in KCSE in public secondary schools in Kitui Rural Sub-County, Kitui County.

Availability of Instructional Materials

Factor	Not at All Influential	Slightly Influential	Somewhat Influential	Very Influential	Extremely Influential
Availability of Textbooks	[]	[]	[]	[]	[]
Access to Digital Resources	[]	[]	[]	[]	[]
Sufficiency of Teaching Aids	[]	[]	[]	[]	[]
Timeliness of Material Availability	[]	[]	[]	[]	[]
Variety of Instructional Materials	[]	[]	[]	[]	[]

Quality of Instructional Materials

Factor	Not at All Influential	Slightly Influential	Somewhat Influential	Very Influential	Extremely Influential
Alignment with Curriculum Standards	[]	[]	[]	[]	[]
Relevance of Content	[]	[]	[]	[]	[]
Up-to-Date Information	[]	[]	[]	[]	[]

Effectiveness of Visual Aids	[]	[]	[]	[]	[]
Clarity of Explanations in Textbooks	[]	[]	[]	[]	[]

Utilization of Instructional Materials

Factor	Not at All Influential	Slightly Influential	Somewhat Influential	Very Influential	Extremely Influential
Frequency of Textbook Use in Class	[]	[]	[]	[]	[]
Integration of Digital Resources in Lessons	[]	[]	[]	[]	[]
Student Engagement with Instructional Materials	[]	[]	[]	[]	[]
Effectiveness in Enhancing Understanding	[]	[]	[]	[]	[]
Teacher's Skill in Utilizing Materials	[]	[]	[]	[]	[]

Objective 4: To analyze the influence of the classroom environment on mathematics performance in KCSE in public secondary schools in Kitui Rural Sub-County, Kitui County.

Physical Classroom Environment

Factor	Not at All Influential	Slightly Influential	Somewhat Influential	Very Influential	Extremely Influential
Adequacy of Classroom Space	[]	[]	[]	[]	[]
Condition of Furniture and Facilities	[]	[]	[]	[]	[]
Cleanliness and Maintenance of Classrooms	[]	[]	[]	[]	[]
Ventilation and Lighting in Classrooms	[]	[]	[]	[]	[]
Availability of Necessary Teaching Equipment	[]	[]	[]	[]	[]

Psychosocial Classroom Environment

Factor	Not at All Influential	Slightly Influential	Somewhat Influential	Very Influential	Extremely Influential
Student-Teacher Interaction	[]	[]	[]	[]	[]

Supportive Learning Atmosphere	[]	[]	[]	[]	[]
Classroom Discipline and Orderliness	[]	[]	[]	[]	[]
Encouragement of Student Participation	[]	[]	[]	[]	[]
Peer Relationships and Collaboration	[]	[]	[]	[]	[]

Learning Climate and Atmosphere

Factor	**Not at All Influential**	**Slightly Influential**	**Somewhat Influential**	**Very Influential**	**Extremely Influential**
Motivation of students to participate in lessons	[]	[]	[]	[]	[]
Reinforcement of positive behavior by teachers	[]	[]	[]	[]	[]
Comfort in expressing opinions in class	[]	[]	[]	[]	[]
Creation of a supportive and respectful environment	[]	[]	[]	[]	[]
Encouragement of problem-solving and critical thinking	[]	[]	[]	[]	[]

I sincerely appreciate your cooperation in this survey.

Appendix IV: Interview guide

1. How do you ensure students stay actively engaged during mathematics lessons, and what challenges do you encounter in maintaining their engagement?
2. In what ways do you use quizzes, tests, or other formative assessments to track and improve student performance in mathematics?
3. How do you incorporate different instructional methods in your mathematics teaching to address students' varying learning needs?
4. How sufficient are the instructional materials (e.g., textbooks, visual aids) available for teaching mathematics in your school?
5. How would you describe the relevance and alignment of the instructional materials with the mathematics curriculum and student needs?
6. How do you integrate available teaching materials into your mathematics lessons, and what challenges do you face in doing so effectively?
7. How do the physical conditions of your classroom (e.g., space, furniture, ventilation) affect your ability to teach mathematics effectively?
8. How would you describe the relationship between teachers and students in your mathematics classes, and how does it impact student performance?
9. What strategies do you use to create a positive and motivating learning atmosphere for mathematics students?
10. How often do you participate in professional development sessions, and how have these sessions impacted your mathematics teaching practices?
11. How does instructional supervision by school leaders influence your teaching practices and student performance in mathematics?
12. How adequately does the school allocate resources (e.g., textbooks, technology) to support mathematics teaching and learning?

Appendix V: Ethical Clearance

Mount Kenya University

REF: **MKU/ISERC/4596**
TO: **KEVIN ORINDO ONGARO**

Date: 22 November 2024

REG: **MED/2021/76928**

Dear Sir/Madam,

RE: INFLUENCE OF SCHOOL-BASED CURRICULUM IMPLEMENTATION DYNAMICS ON MATHEMATICS PERFORMANCE IN KCSE IN PUBLIC SECONDARY SCHOOLS IN KITUI RURAL SUB-COUNTY KITUI COUNTY, KENYA

This is to inform you that **Mount Kenya University** has reviewed and approved your above research proposal. Your application approval number is **3318.** The approval period is **22/11/2024 - 21/11/2025.**

This approval is subject to compliance with the following requirements;

i. Only approved documents including informed consents, study instruments, MTA will be used
ii. All changes including amendments, deviations and violations are submitted for review and approval by **Mount Kenya University**
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to **Mount Kenya University** within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affect the safety or welfare of study participants and others or affect the integrity of the research must be reported to **Mount Kenya University** within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal
vii. Submission of an executive summary report within 90 days upon completion of the study to **Mount Kenya University**

Prior to commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology and Innovation (NACOSTI) https://research-portal.nacosti.go.ke and also obtain other clearances needed.

Yours sincerely,

Dr. Alfred Owino, PhD
Chairman, Mount Kenya University ISERC

MOUNT KENYA UNIVERSITY
ETHICS REVIEW COMMITTEE
P. O. Box 342 - 01000,
THIKA

Main Campus, General Kago Road. P.O. Box 342-01000 Thika.
Tel: 020-2878 000, Cell: +254 709 153 000

Appendix VI: Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **217755**

Date of Issue: **03/December/2024**

RESEARCH LICENSE

This is to Certify that Mr.. Kevin Orindo Ongaro of Mount Kenya University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Kitui on the topic: INFLUENCE OF SCHOOL-BASED CURRICULUM IMPLEMENTATION DYNAMICS ON MATHEMATICS PERFORMANCE IN KCSE IN PUBLIC SECONDARY SCHOOLS IN KITUI RURAL SUB-COUNTY KITUI COUNTY, KENYA for the period ending : 03/December/2025.

License No: **NACOSTI/P/24/414369**

217755

Applicant Identification Number

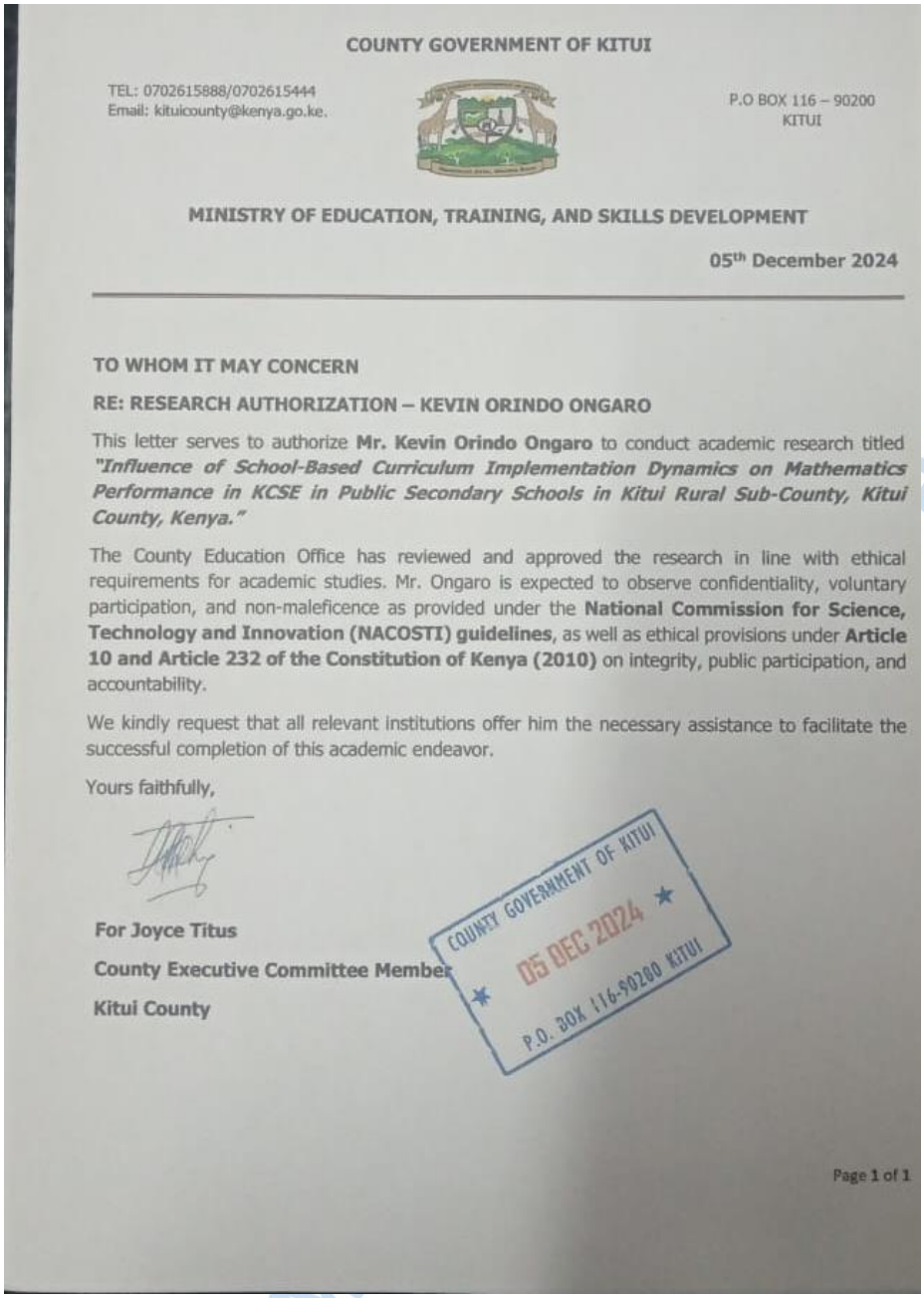
Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

See overleaf for conditions

Appendix VII: Research Authorization



COUNTY GOVERNMENT OF KITUI

TEL: 0702615888/0702615444
Email: kituicounty@kenya.go.ke.

P.O BOX 116 – 90200
KITUI

MINISTRY OF EDUCATION, TRAINING, AND SKILLS DEVELOPMENT

05th December 2024

TO WHOM IT MAY CONCERN

RE: RESEARCH AUTHORIZATION – KEVIN ORINDO ONGARO

This letter serves to authorize **Mr. Kevin Orindo Ongaro** to conduct academic research titled ***"Influence of School-Based Curriculum Implementation Dynamics on Mathematics Performance in KCSE in Public Secondary Schools in Kitui Rural Sub-County, Kitui County, Kenya."***

The County Education Office has reviewed and approved the research in line with ethical requirements for academic studies. Mr. Ongaro is expected to observe confidentiality, voluntary participation, and non-maleficence as provided under the **National Commission for Science, Technology and Innovation (NACOSTI) guidelines**, as well as ethical provisions under **Article 10 and Article 232 of the Constitution of Kenya (2010)** on integrity, public participation, and accountability.

We kindly request that all relevant institutions offer him the necessary assistance to facilitate the successful completion of this academic endeavor.

Yours faithfully,

For Joyce Titus

County Executive Committee Member

Kitui County

COUNTY GOVERNMENT OF KITUI
05 DEC 2024
P.O. BOX 116-90200 KITUI

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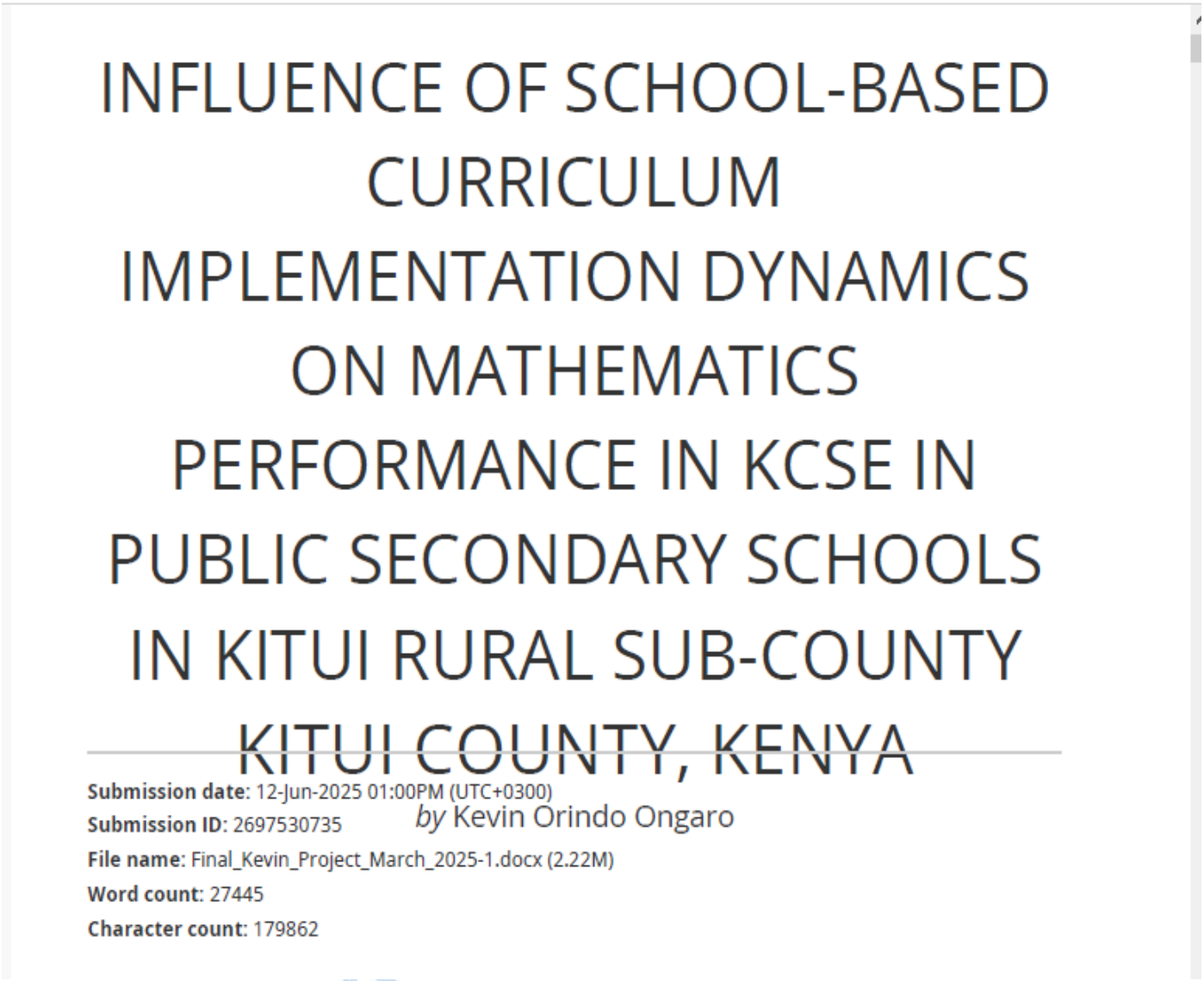
Appendix VIII: Turnitin Report



INFLUENCE OF SCHOOL-BASED CURRICULUM IMPLEMENTATION DYNAMICS ON MATHEMATICS PERFORMANCE IN KCSE IN PUBLIC SECONDARY SCHOOLS IN KITUI RURAL SUB-COUNTY KITUI COUNTY, KENYA

Submission date: 12-Jun-2025 01:00PM (UTC+0300)
Submission ID: 2697530735 *by* Kevin Orindo Ongaro
File name: Final_Kevin_Project_March_2025-1.docx (2.22M)
Word count: 27445
Character count: 179862

INFLUENCE OF SCHOOL-BASED CURRICULUM IMPLEMENTATION DYNAMICS ON MATHEMATICS PERFORMANCE IN KCSE IN PUBLIC SECONDARY SCHOOLS IN KITUI RURAL SUB-COUNTY KITUI COUNTY, KENYA

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Appendix IX: Map of Study Area