COMPETENCY BASED CURRICULUM IMPLEMENTATION AND PERFORMANCE IN MATHEMATICS AMONG GRADE FOUR PRIMARY SCHOOL PUPILS IN MACHAKOS SUB-COUNTY, KENYA

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DECLARATION AND APPROVAL

Declaration by Student

This thesis is my original work and has not been presented for a degree or any other award in any other university.

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DEDICATION

This work is dedicated to my wife, Pastor Dorcas Mumo, my son, Jeremy Muathime, my parents, Sammy Kiilu and Mary Nzuki, my brother David Nzuki, my sisters Faith Nzuki and Claris Nzuki for their unwavering support and encouragement. May God bless you.

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ABBREVIATIONS AND ACRONYMS

ACARA	Australian Curriculum, Assessment and Reporting Authority
CAPS	Curriculum and Assessment Policy Statement
CBC	Competency Based Curriculum
CBE	Competency-Based Education
CEMASTEA	Centre for Mathematics, Science and Technology Education in Africa
CPD	Continuous Professional Development
DQAS	Directorate of Quality Assurance and Standards
EAC	East African Community
ICT	Information and Communications Technology
KICD	Kenya Institute of Curriculum Development
KISE	Kenya Institute of Special Education
KNEC	Kenya National Examination Council
MCEETYA	Ministerial Council on Education, Employment, Training and Youth Affairs
MoE	Ministry of Education
NACOSTI	National Commission for Science, Technology and Innovation
OECD	Organisation for Economic Co-operation and Development
PISA	Program for International Student Assessment
SCDE	Sub County Director of Education
SPSS	Statistical Packages for Social Sciences
TIMSS	Trends in International Mathematics and Science Study
TSC	Teachers Service Commission

TTC	Teacher Training Colleges
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United State

ABSTRACT

Despite the introduction of CBC aimed at improving practical skills and competences, persistent problems remain, including inadequate teacher training, limited resources and large class sizes. The research was guided by four objectives; to establish how teachers' of Mathematics induction on CBC affects performance in Mathematics, to determine how adoption of new CBC lesson planning strategies by Mathematics teachers affects performance, to establish how Mathematics teachers' adoption of new CBC assessment strategies affects performance, to establish how the supervision of the implementation of CBC affects performance in Mathematics among Grade 4 pupils. The study adopted the constructivist theory of learning. It further employed a mixed-methods research design. The target population included all the primary schools, head teachers, grade 4 mathematics teachers and grade four pupils from all public and private primary schools from Machakos Sub-County. This study adopted the multi-stage sampling technique: stratified random sampling was used to select 19 public primary and 5 private primary schools in Machakos Sub-county; in each of the 24 sampled schools, one grade 4 stream was randomly sampled; one head teacher was purposively sampled and the one grade 4 mathematics teacher for the sampled stream was purposively sampled. The sample comprised of 19 public primary and 5 private primary schools, 24 head teachers, 24 teachers of mathematics and 337 grade 4 pupils. The reliability of the instruments was established using the Cronbach Alpha attaining 0.82. The quantitative data was analyzed using the SPSS Version 28, while qualitative data was analyzed using Thematic Analysis. The results of the study demonstrated that; efficient implementation of the CBC strategies greatly enhanced performance in Mathematics among Grade 4 pupils. In this regard, teachers were adequately inducted on CBC, grade 4 mathematics teachers' adopted new lesson planning and schemes of work under CBC, adopted various assessment methods as spelt out in the new CBC and teacher's supervision on the implementation of the CBC was very crucial. The study recommends that the Ministry of Education should create comprehensive and ongoing professional development programs that focus not only on the theoretical aspects of the Competency-Based Curriculum (CBC) but also on practical application in the classroom ,ensure that schools have sufficient teaching resources and materials that are aligned with the CBC framework, implement robust accountability systems for teachers to ensure consistent participation in professional development programs and adherence to CBC standards and encourage schools to actively involve parents and communities in the learning process, especially in mathematics education.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter presents the background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, assumptions of the study, delimitation of the study, limitations of the study and definition of terms.

1.1 Background to the Study

Education systems around the world have evolved significantly in recent decades, reflecting a shift towards more holistic, learner-centered approaches. Competency-based curriculum (CBC) is one such approach that emphasizes students' ability to apply knowledge and skills in real-world contexts rather than simply memorizing facts (Boud and Falchikov, 2006). The goal of this paradigm shift is to develop students who are not only informed, but also qualified and adaptable (OECD, 2015). Competency-based education (CBE) has been introduced worldwide with varying degrees of success. For example, in the United States, CBE has been integrated into many state education systems to ensure that students achieve specific competencies before advancing to the next level (Wallace Foundation, 2016).

The effectiveness of these programs has been mixed, with some studies suggesting improved student engagement and performance, while others highlight issues such as inadequate teacher preparation and resource constraints (U.S. Department of Education, 2016). In Australia, the adoption of a competency-based approach has been associated with significant changes in curriculum design and assessment methods. The Australian

Curriculum, Assessment and Reporting Authority (ACARA) has highlighted the importance of providing opportunities for students to demonstrate their abilities in a range of areas of education (ACARA, 2016). This approach has been well received, particularly in the vocational education and training sectors, where it is well suited to the needs and expectations of industry (Smith and Keating, 2013).

In Africa, the shift towards competency-based education reflects wider regional trends towards improving the quality and relevance of education. Many African countries have recognized the need for educational reforms that address both high school dropout rates and the mismatch between educational outcomes and labor market needs (African Union, 2018). Competency-based curricula are seen as a way to equip students with practical skills that are more relevant to the demands of the 21st century. In countries such as Nigeria and Ghana, competency-based education has been introduced as part of broader education reforms aimed at improving the quality of learning and teaching (Okebukola, 2016).

In these regions, the emphasis is often on improving literacy and numeracy along with practical competencies that can facilitate economic development and personal empowerment (World Bank, 2017). The East African region has also been active in reforming its education systems. For example, Uganda and Tanzania have implemented competency-based approaches to improve educational outcomes and align curricula with regional and global standards (Mugisho, 2016). This effort is part of a broader regional strategy to increase the quality and relevance of education in East Africa.

In Kenya, the shift to a competency-based curriculum (CBC) represents a significant shift from the traditional 8-4-4 system to a model that prioritizes student-centered

education and the development of practical skills (Kenya Institute of Curriculum Development, 2018). CBC was introduced to address the shortcomings of the previous curriculum, which was criticized for its emphasis on rote learning and limited focus on skill application (Gikunda, 2017). Implementation of CBC in Kenya began in 2017 to improve educational outcomes by focusing on competencies such as critical thinking, problem solving and communication skills (Republic of Kenya, 2019). This approach is in line with the global trend towards competency-based education, but is adapted to meet local educational needs and contexts.

In Machakos sub-county, the implementation of CBC encountered various challenges and opportunities. Teachers were trained to adapt to the new curriculum and schools were provided with new materials and resources (Machakos County Education Office, 2020). However, the effectiveness of these efforts in improving student performance, particularly in subjects such as mathematics, remains an area of active research and evaluation.

Even though there is no problem with borrowing from other educational systems globally, there is evidence that Kenya’s curriculum developers took into consideration the capacity of teachers training and their preparedness to transition into a new curriculum by training of different education field officers who are involved in the implementation of the Competence Based Curriculum (Ondimu 2018). In Machakos sub-county, the problem of poor math performance among fourth grade primary school students persists. This issue is a serious issue because mathematics is a foundational subject that is critical to students' overall academic development and future opportunities.

Table 1.1: 2022 KNEC KPSEA Results for Machakos Sub County

Level	Exceeding Expectations	Meeting Expectations	Approaching Expectations	Below Expectations	Total
Entry	500	500	700	1500	3200
%	**15.6 %**	**15.6 %**	**21.9 %**	**46.9%**	**100%**

Source: Machakos County Education Office (2025)

Table 1.2: 2023 KNEC KPSEA Results for Machakos Sub County

Level	Exceeding Expectations	Meeting Expectations	Approaching Expectations	Below Expectations	Total
Entry	567	689	1000	1400	3656
%	**15.5%**	**18.8%**	**27.4%**	**38.2%**	**100%**

Source: Machakos County Education Office (2025)

1.2 Statement of the Problem

Despite the introduction of the Competency-Based Curriculum (CBC), which was designed to improve educational outcomes by emphasizing practical skills and competencies, student performance in mathematics remains below average. This situation highlights a fundamental gap in research that needs to be addressed. Teachers, parents, and education stakeholders have been voicing concerns about the persistent poor performance of fourth graders in mathematics within Machakos sub-county. They have complained that, despite the curriculum's goals, students are still struggling with basic mathematical concepts, and there is a sense of frustration regarding the effectiveness of the new curriculum.

A competency-based curriculum aims to shift the educational focus from rote learning to the development of practical skills and competencies that are relevant to students' everyday lives. However, there is a lack of detailed research on how effectively CBC

is implemented in Machakos sub-county and its actual impact on mathematics performance. While the goals of CBC are clear, its practical application and effectiveness in improving mathematics instruction in this specific context are not well documented.

In addition, the local educational environment in Machakos sub-county presents unique challenges such as limited resources, varying levels of teacher training, and large class sizes. These factors may influence the implementation of CBC and consequently impact student performance in mathematics. Teachers often report feeling unprepared or inadequately trained to deliver the curriculum effectively, which further hampers student learning outcomes. Despite these challenges, there is insufficient research examining how these contextual factors interact with CBC implementation to affect student outcomes.

Furthermore, there is a notable absence of systematic evaluation and feedback mechanisms involving teachers, students, and administrators. Without ongoing assessment and input, it becomes difficult to identify specific areas where the curriculum may need adjustment or to accurately measure its impact. The lack of a feedback loop limits the ability of stakeholders to make informed decisions aimed at improving mathematics instruction. In summary, the main problem is the lack of comprehensive understanding regarding the implementation of the CBC and its effectiveness in improving the mathematics performance of fourth graders in Machakos sub-county. Teachers, parents, and other educational stakeholders have expressed concerns about the persistent low performance in mathematics, emphasizing the urgent need for targeted research. Existing research gaps include limited teacher readiness to

implement CBC in Kenyan primary schools, unclear whether resource availability or resource utilization affects performance, and a lack of localized studies on the practical application of CBC. Additionally, there is a deficiency of research addressing the interaction between contextual issues and CBC implementation, as well as the absence of systematic evaluation mechanisms for measuring progress.

Addressing these gaps is critical to developing targeted strategies to improve mathematics performance and ensuring that CBC effectively meets the educational needs of students in the region. The present study, therefore, investigates the relationship between the implementation of CBC strategies and mathematics performance among Grade 4 pupils, with the aim of providing insights that can help bridge these research and practical gaps.

1.3 Purpose of the Study

The purpose of the study was to explore the extent to which CBC has been implemented and the effect on performance in Mathematics among grade 4 pupils in public and private primary schools in Machakos Sub-County, Machakos County, Kenya.

1.4 Objectives of the Study

1. To establish how teachers' of Mathematics induction on CBC affects performance in Mathematics among Grade 4 pupils.
2. To determine how adoption of new CBC lesson planning strategies by Mathematics teachers affects performance among Grade 4 pupils.
3. To establish how teachers of Mathematics adoption of new CBC assessment strategies affects performance among Grade 4 pupils.

4. To establish how the supervision of the implementation of CBC affects performance in Mathematics among Grade 4 pupils.

1.5 Research Questions

1. How does teachers of Mathematics induction on CBC affect performance in Mathematics among grade four pupils?
2. In what ways does the adoption of new CBC lesson planning by Mathematics teachers influence performance among grade four pupils?
3. What is the effect of the adoption of new CBC assessment strategies by teachers of Mathematics on performance among grade four pupils?
4. What impact does CBC supervision have on the performance of grade four pupils in Mathematics?

1.6 Significance of the Study

The study may be useful to CBC developers at KICD in their review of primary school Mathematics syllabus in planning and assessment. The study may also help the Ministry of Education in their formulation of policies for the implementation of teaching Mathematics that is learner-centered. The study may also be of great significance to Mathematics teachers in that it will equip teachers with a framework for improving the teaching of Mathematics. This will make learning to be more practical than theoretical and therefore help the teachers achieve teaching goals more easily, to the school Head teachers in that it may help the school administrator understand how to implement CBC under better supervision and impact positively on Mathematics teaching and learning, to the Directors of quality Assurance where they learn the areas needing improvement that can impact and make Mathematics learning better under CBC and to the learners

where the findings may be used to get learners through a more practical learning rather than theoretical learning of Mathematics that perfectly models the learners for the future.

1.7 Limitation of the study

One limitation of this study was the potential for response bias, as teachers and head teachers may have provided socially desirable answers during questionnaires and interviews, affecting data accuracy. Additionally, the mixed-method design, while comprehensive, was time-consuming and required careful integration of qualitative and quantitative data, which could have led to inconsistencies or challenges in data interpretation. The study also relied on self-reported data, which may not have accurately reflected actual classroom practices or student performance. Furthermore, the focus on Machakos Sub-County limited the generalizability of the findings to other regions with different educational contexts.

1.8 Assumptions of the Study

Assumptions of a study are the conditions that determine whether the research questions are valid and adequate (Creswell, 2014). The following are the assumptions for the study; that CBC implementation has a great influence on performance in Mathematics, Knowledge of the effects of CBC implementation factors may greatly enhance Mathematics teaching at Primary school level and the participants in the study will provide responses honestly.

1.9 Delimitation of the Study

Delimitations are determinations made by the researcher that describe the boundaries of the study and challenges the researcher imposes on the research design (Komba,

2015). According to Creswell (2014), delimitations focus on the central phenomenon, the study participants, and the specific type of research design. This study was delimited to the relationship between the adoption of CBC strategies and performance in mathematics among Grade 4 pupils. The participants included Grade 4 pupils, head teachers, and grade 4 mathematics teachers in both public and private primary schools in Machakos Sub-County.

1.10 Definition of Terms

New learning strategies: Refers to the laid down procedure in the introduction of new strategies in seeking to better the existing guidelines and way of achieving set goals and objectives.

Assessment Strategies: Refers to methods used to gauge or determine the how head teachers, teachers, and students perform.

Competency-Based Curriculum (CBC): Refers to the system of instructions, assessment, grading, and academic reporting that is based on the students demonstrating what they have learned, the knowledge and skills they are expected to learn as they progress through their education.

Curriculum-Based Education Curriculum-Based Education is an instructional approach that integrates curriculum content directly into assessment and teaching practices to enhance student learning outcomes.

Competency: Refers to application of knowledge, skills and attitude in different situations.

Gaps in Supervision: Refers to the problems experienced during provision of quality education in learning institutions.

Implementation: Refers to the processes and practices of putting the CBC plan into execution.

Implementation Factors: Factors enabling learning: learner, resources, environment, teachers, assessment.

Teacher Induction: Provision of professional support to teachers under guidance of professionals.

Performance: Accomplishing or achievement of specific goals, objectives set in any academic undertaking in basic mathematics.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter contains literature related to Competency Based Curriculum implementation and the performance in Mathematics among Grade 4 primary school pupils. The critical review is discussed under various sub-themes including the extent Mathematics teachers' induction affects performance in Mathematics on CBC implementation, extent to which adoption of new lesson planning by Mathematics teachers affects performance in implementation of CBC, extent to which embracement of new assessment strategies by Mathematics teachers affects performance in Mathematics and how the gaps in the supervision of the implementation of CBC affect performance in Mathematics among Grade 4 pupils in Machakos Sub-county. Further, a summary of literature review, theoretical and conceptual frameworks are included in this chapter.

2.2 Competency Based Curriculum Implementation

Competency-based curriculum (CBC) frameworks have been adopted globally as a strategy to improve educational outcomes by focusing on the development of specific skills and competencies rather than simply covering content (Lievens & Mulder, 2019). Globally, countries such as Finland, Australia, and Canada have successfully implemented CBC models that emphasize critical thinking, problem solving, and applied knowledge in their education systems (Lovat et al., 2020). In Finland, for example, curriculum reform is credited with promoting a more student-centered learning environment where mathematical competencies are developed through practical application and collaborative learning (Sahlberg, 2011).

Similarly, the Australian curriculum framework places considerable emphasis on competencies, ensuring that students are well prepared for future educational and professional challenges (MCEETYA, 2008). The success of these implementations is often attributed to robust teacher training programs, ongoing curriculum evaluation, and strong political support. Countries that have adopted CBC models also tend to invest heavily in teacher professional development to ensure that educators can effectively deliver competency-based instruction (Darling-Hammond, 2017). This global perspective highlights the importance of comprehensive support systems to achieve successful CBC implementation.

In the African context, the adoption of CBC frameworks varies widely. Countries such as South Africa and Ghana have initiated curriculum reforms aimed at embedding competencies in their education systems. The South African Curriculum and Assessment Policy Statement (CAPS) emphasize outcomes-based education that aligns with CBC principles by focusing on what students should be able to do with their knowledge (Department of Basic Education, 2011). Similarly, Ghana's reform efforts are aimed at aligning the curriculum with the practical skills and competencies necessary for the 21st century (Ghana Education Service, 2020). However, the implementation of CBC in many African countries faces significant challenges. Issues such as limited resources, inadequate teacher training and socio-economic disparities often hinder the effective implementation of competency-based initiatives (UNESCO, 2021). Despite these challenges, regional efforts aim to overcome these barriers through collaborative approaches and regional policy frameworks that emphasize quality education and inclusiveness (African Union, 2016).

Kenya's move towards a competency-based curriculum (CBC) began with the introduction of a new curriculum framework in 2017. The CBC was designed to address the limitations of the previous education system, which was heavily focused on routine learning and national examinations. The new curriculum emphasizes practical skills, critical thinking and a holistic approach to education (Kenya Institute of Curriculum Development [KICD], 2020). Early reports suggest that CBC implementation has had a mixed impact on elementary school students' performance in mathematics. According to KNEC (2021), although there have been improvements in certain areas; challenges remain, particularly in terms of resource allocation and teacher preparedness. Several factors influence the effectiveness of CBC in improving mathematics performance, including the adequacy of instructional materials, the level of teacher preparation, and the extent to which the curriculum is integrated into classroom practice (Sifuna, 2020).

In Machakos sub-county, the center of which the research focused, CBC implementation has seen both progress and challenges. Schools in the region have made efforts to adapt to the new curriculum, but challenges such as large class sizes, insufficient teaching resources and varying levels of teacher competence continue to affect performance outcomes (Mwaura et al., 2019). The local context also presents unique challenges, including socio-economic factors that affect access to and quality of education. Global and regional experiences with CBC highlight the critical need for targeted support to ensure successful implementation. In Kenya, while the CBC represents a significant step towards a more effective education system, its success depends on addressing several key factors. First, investment in comprehensive teacher training programs is essential. Second, it is essential to improve resource allocation and infrastructure. Schools in Machakos and similar regions often struggle with limited

resources that can hinder the effective implementation of CBC. Finally, fostering community and parent involvement can play a key role in improving educational outcomes.

2.3 Performance in Mathematics

Performance in mathematics varies significantly around the world and is influenced by educational systems, cultural attitudes and resource availability. According to the Program for International Student Assessment (PISA) reports, countries such as China, Singapore and Hong Kong consistently rank high in mathematics performance (OECD, 2022). These countries typically emphasize rigorous curriculum standards, rigorous testing, and extensive teacher education programs (Hattie, 2009). Conversely, countries with less developed educational infrastructure often struggle with lower performance indicators. For example, low student achievement in several sub-Saharan African countries has been attributed to insufficient resources, less qualified teachers and inadequate support mechanisms (UNESCO, 2021).

The Global Competence Framework provided by the OECD also emphasizes the role of socio-economic factors in mathematics achievement. Students from affluent backgrounds often have better access to learning resources and extracurricular support, leading to higher performance (OECD, 2022). This global perspective underscores the complex interplay between educational quality, socioeconomic status, and performance.

In Africa, performance in mathematics is influenced by different educational practices and levels of resource availability. The Trends in International Mathematics and Science Study (TIMSS) shows that African countries, including Kenya, often perform

below the global average in mathematics (Mullis et al., 2020). Contributing to this are inadequate educational materials, overcrowded classrooms and a lack of qualified teachers. The African Union Education and Training Strategy highlights the need for significant investment in education to address these disparities and improve literacy across the continent (African Union, 2016). Regional initiatives such as the East African Community (EAC) Education Strategy aim to improve educational outcomes by standardizing curricula and supporting teacher development (EAC, 2020). Despite these efforts, disparities persist, particularly in rural areas where access to quality education is limited.

In Kenya, mathematics performance among primary school students has shown mixed results. The implementation of the Competency-Based Curriculum (CBC), introduced in 2017, aims to shift the focus from rote learning to the development of practical skills and competencies (Kenya Institute of Curriculum Development [KICD], 2020). Early evaluations indicate that CBC has achieved some success in engaging students more actively in the learning process, although challenges remain. Performance data from the Kenya National Examinations Council (KNEC) shows that mathematics remains a challenge. Although there have been improvements in overall literacy rates, students often struggle in mathematics due to factors such as insufficient teaching resources, large class sizes and varying levels of teacher competence (KNEC, 2021).

Mwaura et al. (2019) highlighted that, despite curriculum reforms, a performance gap in mathematics between urban and rural schools persists due to differences in resource allocation and teacher education. Aligning curriculum changes with effective classroom practices is a significant challenge in the Kenyan context. While CBC aims to promote

a more holistic educational approach, its success depends on comprehensive teacher training and consistent implementation (Sifuna, 2020). In addition, parental involvement and community support play a critical role in improving student achievement, but these aspects are often undervalued.

The global and regional problems observed in mathematics underline the need for a multifaceted approach to improving education. In Kenya, the move to a competency-based curriculum is a promising development, but its success will largely depend on addressing systemic issues such as teacher training, resource allocation, and community engagement. Strengthened support for teachers, along with increased investment in educational resources, can close identified performance gaps. Learning from global best practices such as integrating technology into education and fostering a culture of continuous assessment and feedback could benefit Kenyan education practices. Fostering collaborative approaches among educators, policymakers, and communities can also facilitate more effective curriculum implementation and improve overall student performance in mathematics.

2.3.1 Teacher Induction and Performance in Mathematics

The implementation of competency-based curricula (CBC) has received significant attention worldwide, particularly in terms of its impact on student performance in key subjects such as mathematics. The primary objective of the CBC is to equip students with the essential skills and competencies that will enable them to effectively navigate real-world challenges. In various educational contexts, several studies have shown that CBC can lead to increased student engagement and improved performance, especially when teachers are adequately trained and supported in new pedagogical approaches

(Wiggins & McTighe, 2005). Globally, the move towards CBC reflects a growing recognition that simply imparting knowledge is not enough to prepare students for a complex and rapidly evolving world (UNESCO, 2016).

Countries such as Finland and Singapore have adopted CBC principles and integrated experiential learning and critical thinking into their mathematics curricula. Research has shown that students in these systems demonstrate higher levels of mathematical reasoning and problem-solving skills compared to their peers in traditional curricula (Killen, 2015). The success of these models underscores the importance of teacher training and ongoing professional development in effective CBC implementation, as teachers are instrumental in translating curriculum goals into classroom practice (Darling-Hammond, 2017). In the African context, the challenges associated with CBC implementation are linked to various socio-economic and infrastructural factors. Many countries on the continent, including Kenya, have embarked on curriculum reforms aimed at aligning educational outcomes with the needs of the labor market and society (African Union, 2018). The African Union's Agenda 2063 emphasizes the importance of education in promoting innovation and economic growth and highlights the need for competency-based approaches (AU, 2018). However, the extent to which these reforms improve student performance in mathematics remains insufficient.

In Kenya, CBC implementation is characterized by optimism and apprehension. The Kenya Institute of Curriculum Development (KICD) has spearheaded the implementation of CBC, which emphasizes student-centered teaching methods, practical application of knowledge and an assessment framework that reflects competence rather than mere retention of content (KICD, 2019). The aim of this reform

is to improve performance in critical subjects such as mathematics, which are the foundation of science and engineering education. However, the successful implementation of CBC in Kenya largely depends on the readiness and support of teachers. Studies reveal that many teachers feel inadequately trained to effectively implement the new curriculum, raising concerns about the quality of mathematics education (Ochieng & Nasasu, 2020). Teacher training programs are essential to equip educators with the skills and confidence needed to successfully implement CBC. A well-structured adaptation process can increase teachers' content knowledge and pedagogical skills, which in turn can improve student achievement (Ingersoll, 2001). Research shows that engaging teachers in Continuous Professional Development (CPD) initiatives fosters a deeper understanding of competency-based methodologies, enabling them to effectively implement innovative teaching strategies (Guskey, 2002).

In Kenya, teacher professional development models that are collaborative, ongoing, and contextually relevant have shown promise in improving teacher capacity, thereby improving student achievement in mathematics (Ngoya, 2021). In conclusion, while the implementation of a competency-based curriculum presents opportunities to improve fourth-grade students' mathematics achievement in Machakos Sub-County, it requires a concerted effort in teacher education and sustained support. Experiences from global practice and African contexts underscore the essential role of well-prepared educators in a successful transition to a competency-based approach. Future research should delve deeper into specific strategies that can effectively support teachers in this transformation and ultimately contribute to improving outcomes in mathematics education.

2.3.2 The Adoption of New Lesson Planning Strategies and Performance in Mathematics

A lesson plan is a written description for the process where the materials, the strategies, the time and the learning environment as well as methods of evaluating the learner levels of progress are archived in detail (Mosha, 2012). A lesson plan outlines the procedure which provides direction for a teacher of the choice of relevant resources to assist in the delivery of tasks taught and how to teach them (Williams, 2005). The shift to competency-based education (CBE) is a global trend that emphasizes the development of practical skills and competencies rather than mere content knowledge. The effectiveness of this educational paradigm is particularly relevant to mathematics instruction, as numerous studies show that CBE can improve students' problem-solving abilities and overall mathematical performance (Elliott & Nussbaum, 2016). In countries such as Finland and Singapore, the adoption of skills-based curricula has led to better student achievement in mathematics, highlighting the need for effective lesson planning strategies that align with these educational goals (OECD, 2019).

In African countries, the implementation of CBE and the adoption of new lesson planning strategies have met with mixed results due to varying levels of infrastructural support, teacher training, and curriculum resources. According to Omujuwa (2017), many African countries have recognized the importance of innovation in educational approaches to meet contemporary learning demands. The introduction of student-centered teaching methods, particularly in subjects such as mathematics, aims to equip students with the critical thinking and analytical skills necessary to succeed in a rapidly evolving job market.

In Kenya, the government has been actively promoting a competency-based curriculum since the introduction of the Kenya Vision 2030, which prioritizes comprehensive education reform. The aim of the new curriculum framework is to promote creativity, critical thinking and practical skills in pupils (KICD, 2020). However, the successful implementation of this curricular strategy requires the adoption of new lesson planning methods that focus on active learning, collaborative activities and comprehensive assessment tailored to the individual needs of students (Musumba, 2021). Recent studies show that teachers' readiness to implement CBE in mathematics is a critical factor in its success.

A survey conducted by Wafula (2022) found that many teachers in Machakos sub-county lack adequate training in competency-based curriculum principles, resulting in ineffective lesson planning and teaching methodology. This lack ultimately contributes to lower student achievement in mathematics, as educators may revert to traditional lecture-based methods that do not engage students and allow for deep understanding (Orodho, 2018). Furthermore, the role of lesson planning strategies in effective mathematics teaching cannot be underestimated. A study by Ngoya (2021) highlights that lesson plans incorporating a variety of instructional strategies, including hands-on activities, group work, and technology integration, significantly improve student engagement and achievement. These innovative lesson plans allow students to actively build their knowledge and foster a sense of ownership over their learning processes.

In conclusion, the implementation of a competency curriculum in mathematics requires a paradigm shift in lesson planning strategies among teachers in Kenya. While the global trend toward competency-based education shows promising improvements in

math performance, local issues such as inadequate training and resource constraints need to be addressed. As educators in Machakos sub-county align their lesson planning with CBE principles, ongoing professional development and support is essential to translate these initiatives into improved student achievement in mathematics.

2.3.3 Assessment Strategies and Performance in Mathematics

The global learning landscape increasingly embraces competency-based curriculum (CBC) models that emphasize the need for students to develop skills and competencies that enable them to apply knowledge in real-world contexts. This shift is driven by the recognition that traditional rote learning methods do not adequately prepare students for the complexities of modern life and the workforce (OECD, 2018). In this context, effective assessment strategies in mathematics are essential, as they play a vital role in determining performance outcomes and ensure that students can demonstrate mastery of basic skills.

Globally, assessment strategies have evolved to include formative and summative assessments that emphasize critical thinking, problem solving and the practical application of mathematical concepts. Formative assessments such as quizzes, peer assessment, and observational methods allow teachers to monitor progress and modify instruction accordingly (Black & Wiliam, 1998). Conversely, summative assessments focus on evaluating student learning at the end of a unit of instruction by comparing it to standardized benchmarks. Research has shown that schools using a balance of both types of assessment achieve better results because they encourage ongoing engagement and reflection among students (Harris & Brown, 2018). In the African context, the incorporation of competency-based approaches has gained momentum, especially as

countries seek to respond to educational demands resulting from globalization and technological advancement. For example, several countries have initiated reforms to align educational practices with the competencies required in the labor market (African Union, 2016).

Despite this progress, the effectiveness of these approaches is limited by issues such as inadequate teacher preparation, limited resources, and contextual socioeconomic factors. A study by Mugo and Kabiru (2020) highlights that in many African countries, including Kenya, CBC implementation remains inconsistent and assessment practices lag behind pedagogical reforms. In Kenya, the introduction of a competency-based curriculum aims to promote holistic education that equips students with practical skills. The Kenya Institute of Curriculum Development (KICD, 2019) emphasizes that effective assessment should reflect students' abilities to apply mathematics in a variety of contexts. Findings from many local studies indicate that when teachers use a variety of assessment strategies—such as project-based learning, oral presentations, and real-life problem solving—students demonstrate improvements in mathematics (Ngoya, 2021).

However, challenges remain in achieving consistency in the implementation of these strategies across schools, particularly in rural areas such as Machakos sub-county, where resource constraints may limit the implementation of innovative assessment methods (Orodho, 2018). Research suggests a correlation between the types of assessment methods used and student performance in mathematics. For example, teachers who integrate formative assessment report higher student engagement and understanding of math concepts (Mbagaya, 2020). Yet there is a significant gap in

teacher education regarding effective assessment strategies within CBC, as many educators still rely on traditional assessment methods that emphasize memorization over application (Waweru & Kihoro, 2021).

In conclusion, while global trends and regional initiatives lead to the adoption of competency-based educational frameworks, effective assessment strategies should be prioritized to improve mathematics performance. In Kenya, especially in regions such as Machakos sub-county, equitable access to training and resources is essential for the successful implementation of CBC and subsequent improvement in student achievement in mathematics. Addressing these differences will be critical to realizing the intended benefits of CBC

2.3.4 Supervision of the Implementation of CBC and Performance in Mathematics.

The move towards competency-based education (CBE) around the world reflects a growing recognition of the need for education systems to equip students with appropriate skills for life and work. This pedagogical shift emphasizes not only the mastery of the subject matter, but also the ability to apply knowledge and skills in real contexts (Lau & Lim, 2018). Globally, studies show that competency-based curricula increase student engagement and critical thinking, especially in subjects such as mathematics that have traditionally relied on rote teaching (Dede et al., 2016). Across Africa, adoption of competency-based curricula varies, with several countries working to align their education systems with international best practices. The African Union's Agenda 2063 emphasizes the need for educational reforms that respond to the evolving demands of the labor market (African Union, 2015).

Research shows that when competency-based education is implemented effectively, it can significantly improve student achievement in math and other STEM subjects. For example, a study conducted in South Africa revealed that schools that adopted a competency-based approach saw improvements in students' problem-solving and mathematical reasoning skills (Reddy et al., 2019). The introduction of the Competency-Based Curriculum (CBC) by the Ministry of Education in Kenya in 2017 has sparked considerable debate about its effectiveness and impact on student performance in key subjects such as mathematics. Several researchers have explored the underlying principles of CBC, emphasizing its focus on learner-centered experiences and holistic skill development (KICD, 2020). However, the successful implementation of CBC is conditional on effective supervision and support systems in schools. Supervision plays a key role in the implementation of CBC by ensuring that teachers follow the new curriculum directions and use appropriate teaching strategies.

Effective supervision supports the professional development of teachers and allows them to adapt teaching methods to meet the diverse needs of students. Studies show that when supervisors actively engage teachers through regular evaluations and targeted training, teacher performance and, in turn, student outcomes improve significantly (Oduor, 2021). The role of school management is also essential; a supportive school environment that facilitates teacher collaboration and resource sharing tends to produce better learning outcomes (Suleiman, 2019). Despite these positive indicators, challenges remain evident in the Kenyan context. Many teachers report feeling underprepared to implement CBC due to limited training and resources (Omondi & Abok, 2022). Additionally, specifications for assessing student performance in the

context of CBC are still evolving, often leading to confusion among educators about how to effectively measure student competency in mathematics.

A study by Mwoma and Muthwii (2020) pointed out that a lack of understanding of assessment frameworks contributes to inconsistent student achievement in mathematics across schools. In addition, the adaptability of teaching materials and assessment tools is essential to meet the objectives of CBC. Researchers have documented that aligning mathematics instruction with curricular competencies can significantly impact student learning outcomes (Koyan & Ovworo, 2021). Active involvement of stakeholders, including parents and community members, improves the learning environment and promotes student engagement in mathematics, thereby improving performance. In conclusion, while the transition to a competency-based curriculum in Kenya presents many opportunities to improve the performance of fourth-grade students in mathematics, its success is highly dependent on effective supervision, teacher preparation, and a supportive learning environment. Continued research and evaluation are essential to refine these practices and to support a strong educational framework that adequately prepares students for future challenges.

2.4 Theoretical Framework

One of the most important theories for studying competency-based curriculum (CBC) implementation and mathematics performance among fourth-grade students is the constructivist theory of learning. Constructivism, developed from the works of leading theorists such as Jean Piaget and Lev Vygotsky, assumes that students construct their understanding and knowledge of the world through experiences and reflections on those experiences (Piaget, 1973; Vygotsky, 1978). This theory is particularly relevant to CBC

in Kenya, which emphasizes active student participation, problem solving, and application of knowledge in real-world situations. Competency-based curriculum application in a competency-based curriculum, the emphasis is on competency rather than simply delivering content.

Constructivism is consistent with this focus as it advocates active learning where students are encouraged to explore, ask questions and engage in hands-on activities. For example, in math classes, students can work in groups to solve real-world problems, allowing them to apply math concepts in practical contexts. This experiential learning approach can potentially lead to deeper understanding and retention of mathematical concepts among fourth graders in Machakos sub-county (Ngoya, 2021). Constructivism encourages active involvement in the learning process. This involvement increases motivation and interest among students, especially in subjects such as mathematics, which may be perceived as challenging by some students (Bransford et al., 2000). By encouraging students to explore and investigate, constructivist methods promote critical thinking and problem-solving skills. This is necessary in the context of CBC, which aims to equip students with the skills necessary for the 21st century (UNESCO, 2015). Constructivist theory recognizes the role of social interactions in learning as emphasized by Vygotsky. Working together in a group promotes communication skills and allows for mutual learning that can be beneficial in different classrooms (Vygotsky, 1978).

Implementing a constructivist approach can be useful for teachers who may be adequately trained in facilitating this type of learning. In Kenya, many teachers may still rely on traditional teaching methods, leading to inconsistencies in how CBC is

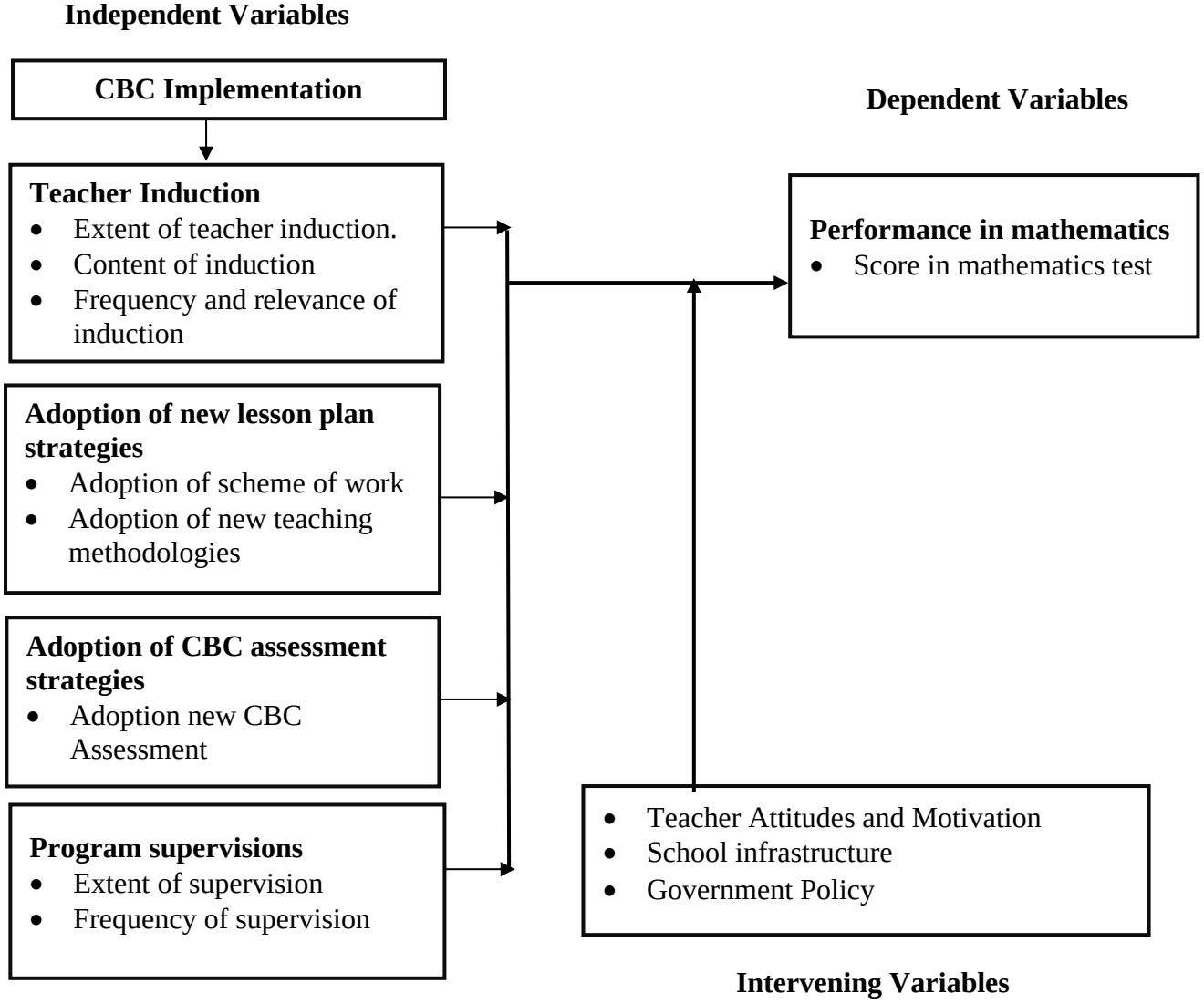
delivered (Orodho, 2018). Constructivist learning often requires a variety of resources and materials to facilitate practical activities. In under-resourced schools, a lack of materials can hinder the effective implementation of a competency-based curriculum (World Bank, 2022). Standardized testing methods focus primarily on memorization and transfer of content, which may not adequately assess competencies cultivated through constructivist methods. This mismatch can create pressures to return to traditional teaching methods (Wiggins & McTighe, 2005). The Constructivist learning theory therefore presents a robust framework for understanding and implementing mathematics competency education among fourth graders in Machakos County, its strengths, such as encouraging active engagement and critical thinking, are consistent with CBC implementation.

The constructivist theory of learning, emphasizes active student participation, experiential learning, and knowledge construction through reflection and social interaction. Its strengths include promoting critical thinking, problem-solving, and deep understanding of mathematical concepts, which align with CBC's goal of developing practical skills and competencies. It also fosters motivation and engagement, especially in subjects like mathematics that students may find challenging. Additionally, it encourages collaboration, enhancing communication and social skills vital for holistic education. However, weaknesses include its heavy reliance on adequate resources, trained teachers, and supportive learning environments; under-resourced schools and untrained teachers may struggle to implement constructivist approaches effectively. Furthermore, standardized assessments often emphasize rote memorization, conflicting with constructivist principles of competency and application, which can pressure teachers to revert to traditional methods. In the context of Machakos County, this theory

is highly applicable for understanding how active, experiential learning can improve mathematics performance among fourth graders. Its emphasis on student-centered learning and social interaction aligns with CBC's objectives, but addressing resource limitations and teacher training remains crucial for successful implementation.

2.5 Conceptual Framework

The conceptual framework for this study is presented in the Figure 2.1



Source: Researcher (2023)

Figure 2.1: Conceptual Framework showing the Relationship between Competency Based Curriculum implementation and the performance in Mathematics among Grade 4 primary school pupils'

In the study, the relationship between the independent variable, CBC (Competency Based Curriculum) implementation, and the dependent variable, performance in mathematics, is influenced by several intervening variables that can either facilitate or

hinder this relationship. CBC implementation encompasses various activities and strategies that directly impact how mathematics is taught and learned. For instance, teacher induction plays a crucial role, as the extent, content, and frequency of induction sessions determine how well teachers understand and embrace the new curriculum. Effective induction equips teachers with the necessary knowledge and confidence to implement CBC effectively. Similarly, the adoption of new lesson plan strategies and schemes of work reflects teachers' willingness and ability to integrate CBC principles into their teaching practices, which directly influences student learning outcomes.

Assessment strategies are also vital; the adoption of CBC-aligned assessment methods ensures that evaluation accurately measures students' competency development, thereby impacting their performance in mathematics. Program supervision, including its extent and frequency, provides ongoing support, feedback, and quality assurance, ensuring that teachers adhere to CBC guidelines and continuously improve their delivery. Intervening variables such as teacher attitudes and motivation significantly influence how effectively teachers implement CBC, as motivated and positive attitudes can enhance teaching quality. School infrastructure and resources support the practical aspects of CBC, ensuring that teachers and students have access to necessary materials and conducive learning environments. Additionally, government policies and the adoption of innovative teaching methodologies can either promote or challenge the successful implementation of CBC. In summary, while CBC implementation directly influences mathematics performance, the actual outcomes are mediated by these intervening variables. Their collective impact determines how effectively the curriculum translates into improved student achievement in mathematics.

2.6 Summary of Literature and Research Gaps

The literature review highlights that competency-based curriculum (CBC) adoption globally, including in Finland, Australia, and parts of Africa like South Africa and Ghana, has improved educational outcomes through emphasis on practical skills, critical thinking, and student-centered learning. Success factors include robust teacher training, ongoing evaluation, and stakeholder support. In Kenya, CBC implementation began in 2017 to address limitations of rote learning, aiming to enhance mathematics performance; however, challenges such as resource shortages, large class sizes, and inadequate teacher preparedness persist, especially in rural areas like Machakos. Effective lesson planning, assessment strategies, and supervision are crucial for successful curriculum delivery, with studies indicating that well-trained teachers using varied assessment methods improve student engagement and achievement in mathematics. Conversely, insufficient training, lack of resources, and inconsistent evaluation hinder progress. Globally and regionally, systemic issues such as infrastructural deficits, socio-economic disparities, and limited support mechanisms impact performance. The literature emphasizes that for CBC to positively influence mathematics outcomes, sustained teacher professional development, resource allocation, stakeholder involvement, and effective supervision are essential. Overall, while CBC offers significant potential, its success hinges on addressing contextual challenges through targeted support and continuous evaluation. The research gap involves limited understanding of CBC implementation's effectiveness in Machakos, including resource impacts, teacher readiness, contextual challenges, and lack of systematic evaluation, hindering improvements in fourth-grade mathematics performance and curriculum optimization.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section describes the research design, sampling techniques and sample size, research instrument, validity and reliability of the instrument, data collection procedure, data analysis techniques and ethical considerations.

3.2 Research Design

The study employed a mixed-methods design, combining quantitative data from standardized mathematics test scores of 4th graders at selected elementary schools with qualitative data gathered through interviews and focus group discussions with teachers and administrators. This approach provided a comprehensive understanding of student performance while also exploring the contextual factors, challenges, and successes related to the implementation of the competency-based curriculum (CBC). The mixed-methods design enabled the researchers to triangulate findings, offering richer insights into how curriculum implementation influences learning outcomes and addressing both statistical trends and stakeholder perspectives. According to Johnson et al. (2022), mixed-methods research enhances the depth and validity of educational studies by integrating numerical data with contextual insights, which is crucial for evaluating complex interventions like curriculum reforms.

3.3 Location of Study

The location of the study is Machakos Sub-County, which stretches from latitude 0° 45´ South to 1° 31´ and longitude 36° 45´ to 37° 45´ East. It has 7 wards, which are: Kalama, Mua, Mutitini, Machakos Central, Mumbuni North, Muvuti/Kiima-Kimwe,

and Kola. The sub-county has a total of 81 Primary schools. The choice of Machakos sub-County for this study is justified due to its diverse educational environment, where there are 81 primary schools spread across seven wards. This geographic and demographic diversity allows for a comprehensive examination of competency-based curriculum implementation and its impact on fourth grade students' performance in mathematics and provides valuable insights.

3.4 Target population

The target population is a large group of people, which has one or more characteristics in common on which the research study was focused (Kothari 2005). The study targeted the head teachers, teachers of Mathematics and grade four pupils from all the public and private primary schools in Machakos Sub-County. Information available from the sub-county Director of Education (SCDE), Machakos Sub-County shows that there is a total of 81 primary schools in the sub-county. Of these, 64 are public schools while 17 are private ones. As at January 2025, there were 64 school heads in the public schools and 17 in the private schools. At the same time, there were 81 teachers in the sub-county teaching mathematics to Grade Four pupils. Of these, 64 were teaching in public schools while 17 were teaching in private schools. Finally, concerning the pupils, they were 2,842 in public schools while those in private schools they were 526. This provides a total population size of 3,530.

3.5 Sample Size and Sampling procedures

Sampling is the procedure of selecting an adequate number of elements or participants from the population of a study and gaining information on the general characteristics or features as representative of the whole population (Mugenda and Mugenda, 2003).

This study adopted the multi-stage sampling technique: stratified random sampling was used to select 19 public primary and 5 private primary schools in Machakos Subcounty, which formed 30% of the schools in each category (Mugenda and Mugenda, 2003); in each of the 24 sampled schools, one grade 4 stream was randomly sampled; one head teacher was purposively sampled and the one grade 4 mathematics teacher for the sampled stream was purposively sampled. Table 3.1 presents the sample distribution.

Table 3.1: Sampling Matrix

Category	**Target Population**		**Sample Size**		**Sampling Method**	
	Public	**Private**	**Public**	**Private**		**Totals**
Schools	64	17	19 (30%)	5 (30%)	Stratified Random	24
Heads	64	17	19 (30%)	5 (30%)	Purposive	24
Streams	75	21	19 (25%)	5 (23%)	Random	24
Grade 4 mathematics Teachers	64	17	19 (30%)	5 (30%)	Purposive	24

Source: The Researcher (2025)

3.6 Research Instruments

According to Kerlinger (2003), questionnaires and interviews are the main research instruments used to collect data in a survey research study. The study used: Questionnaires for headteachers and grade 4 mathematics teachers; Interview Guide for headteachers; and Competence Mathematics test for Grade Four pupils.

3.6.1 Questionnaires

The questionnaires for head teachers and Grade 4 Mathematics teachers aimed to evaluate their use of the Competency-Based Curriculum (CBC) in planning and assessing Mathematics lessons, as well as their induction and supervision practices. These were closed-ended questionnaires featuring a Likert scale, where respondents selected responses ranging from Strongly Disagree (1) to Strongly Agree (5). This scaling allowed for quantifiable measurement of attitudes, practices, and challenges related to CBC implementation. Such Likert-scale questionnaires are widely used for their simplicity and effectiveness in capturing perceptions and behaviors in educational research (Amin, 2021).

3.6.2 Interview Guide

The interview guide was prepared and used for head teachers. The tool was semi-structured containing both closed and open-ended questions to provide in-depth information. The semi-structured interview guide was designed to facilitate a comprehensive understanding of head teachers' perspectives, combining closed questions for quantitative data and open-ended questions for qualitative insights (Kumar, 2020). This approach allows for flexibility in probing deeper into responses, capturing nuanced information about educational practices and leadership styles. The tool was pre-tested to ensure clarity and relevance, increasing its reliability and validity. Using semi-structured interviews enables researchers to explore specific themes while also allowing respondents to express their views freely, which enriches the data quality and depth of analysis (Kumar, 2020). This method is widely recommended for educational research to gather detailed contextual information.

3.6.3 Competence Mathematics test for Grade Four pupils

The researcher utilized a written Mathematics test to collect information on the educational performance of pupils. The pupils attempted the written test on the cardinal skills in Mathematics which tested skills of reading, writing and calculation of sums. The mathematics test was standardized by ensuring consistent administration procedures, clear instructions, and uniform scoring criteria. The test items were carefully developed and piloted to establish reliability and validity, ensuring that all pupils faced the same questions under similar conditions, allowing for fair comparison of their performance.

3.7 Piloting of the Research Instruments

According to Orodho (2018), Pilot study is the pre-testing of particular research instruments with a view that it might give advance warning about where the main research paper could fail, where research protocols may not be followed, whether proposed methods, instruments are inappropriate or too complicated. An instrument may be unreliable and therefore some revision and improvements may be necessary for it to be able to give a reliable data for the study. The research instruments were pilot-tested in 1 public primary school and 1 private primary school which were randomly selected from Kathiani Sub-County. Kathiani Sub-County was selected for piloting because it offers a representative mix of both public and private primary schools, allowing for diverse feedback on the research instruments.

3.8 Validity of the Research Instruments

Validity is the accuracy and meaningfulness of inferences, which are based on the research results, in other words, validity is the degree to which results obtained from

the analysis of the data actually represent the phenomenon under study (Mugenda and Mugenda, 2003). The researcher sought opinion of supervisors and other research experts from the school of Education, Machakos University to ensure validity of the instrument. The supervisors being experts in education validated the research instruments. The piloting of the instruments also enhanced the validity of the instruments.

3.9 Reliability of the Instruments

According to Mugenda and Mugenda, (2003), reliability refers to the extent to which an instrument measures a variable precisely and gives the same results under the same conditions over time. After piloting the instruments, Likert scale items were subjected to Cronbach alpha test of reliability through the Split-Half method. This measures the internal consistency of elements in a study, how closely related elements or set of items are in as a group or population. Cronbach's alpha was subsequently calculated based on these correlations and was found to be 0.82 suggesting that the instruments had a high level of internal consistency in accordance with recommendation of Mugenda and Mugenda (2003).

3.10 Data Collection Procedures

The researcher obtained an introductory letter from The Graduate School of Machakos University, an Authorization Letter, and a Research Permit from the National Commission for Science, Technology, and Innovation (NACOSTI). Additionally, the researcher sought an authorization letter from The County Director of Education in Machakos. The researcher then made appointments with the primary school head teachers and personally administered the research instruments to the respondents. The

first day in each school was used to arrange for the data collection. The second day was used to administer the competence test to grade 4 learners; the third day was for the administration of the Questionnaires to headteachers and grade 4 mathematics teachers; while the fourth day was used to administer the Interview to the headteachers, to collect qualitative data.

3.11 Data Analysis Technique

According to Orodho (2018), data analysis is the most significant part of any research and the method used for data analysis the backbone or the foundation pillars. During editing, data was checked for completeness before the analysis. The quantitative data were entered and analyzed using descriptive statistical techniques with the help of the Statistical Package for the Social Science (SPSS Version 28). The results were presented in tables, charts, frequencies and percentage distribution. Qualitative data were analyzed thematically and presented in narrative form.

3.12 Ethical Considerations

The study adhered to essential ethical considerations to ensure the integrity and confidentiality of respondents. According to Mutula and Kyalo (2018), research ethics involve a set of values and standards that guide scientific inquiry. The researcher committed to maintaining respondent confidentiality by safeguarding private information and ensuring it was not disclosed to third parties. Respondents were assured that their identities would remain anonymous, and no identifying details would be revealed in any form of communication. Informed consent was obtained by clearly explaining the purpose and procedures of the research, allowing participants to volunteer willingly and provide honest responses through signed consent forms.

Additionally, the researcher took measures to securely store collected data, both physically and digitally. Hard copies of raw data were filed for easy reference, while analyzed data was stored on electronic devices such as CDs and flash drives, ensuring proper data management and protection. These ethical practices fostered trust between the researcher and participants, maintained the integrity of the research process, and complied with standard research ethical guidelines.

CHAPTER FOUR

DATA ANALYSIS, INTERPRETATION AND DISCUSSIONS

4.1 Introduction

Chapter four of the study comprises of findings, interpretation and discussions. The chapter has two main sections: sections one and two. Section one presents the study's response rate, reliability of the data and demographic characteristics of the participants and section two contains an analysis of the results based on the study objectives.

As stated earlier in Section 1.4 of Chapter One, the purpose of this study was to examine the extent to which CBC has been implemented and its effect on performance in Mathematics among Grade 4 pupils in public and private primary schools in Machakos Sub-County. The study therefore addressed itself to the following four objectives:

1. To establish how teachers of Mathematics induction on CBC affects performance in Mathematics in among Grade 4 pupils
2. To determine how adoption of new CBC lesson planning strategies by Mathematics teachers affects performance among Grade 4 pupils
3. To establish how teachers of Mathematics adoption of new CBC assessment strategies affects performance among Grade 4 pupils
4. To determine how the supervision of the implementation of CBC affects performance in Mathematics among Grade 4 pupils

4.2 Response Rate

The data in Table 4.1 show that the study achieved 100% response rate.

Table 4.1: Instruments Response Rate

Category of Participants	Instruments Administered	Instruments Returned	Response Rate (%)
Head Teachers' Interviews	24	24	100
Mathematics Teachers' Questionnaires	24	24	100
Grade Four Pupils' Tests	337	337	100
Overall Response Rate	385	385	100

The 100% response rate from all participants demonstrates high levels of engagement and willingness to take part in the study, thereby enhancing the reliability of the results (Fowler, 2014). Achieving a complete response rate reduces potential bias and strengthens the generalizability of the findings related to the implementation of the competency-based curriculum (Creswell, 2014)

4.3 Participants Demographic Characteristics

In this section was discussed the demographic characteristics of the study's participants. This analysis was based on the salient features of the study subjects.

4.3.1 Gender of Participants

The study reported the Gender of Grade 4 teachers, head teachers and the pupils who participated in the study. Concerning gender of the Grade 4 teachers, Figure 4.1 below shows that 15 (53%) of them were female while nine (47%) were male. This implies that women are embracing science subjects which originally were associated with men.

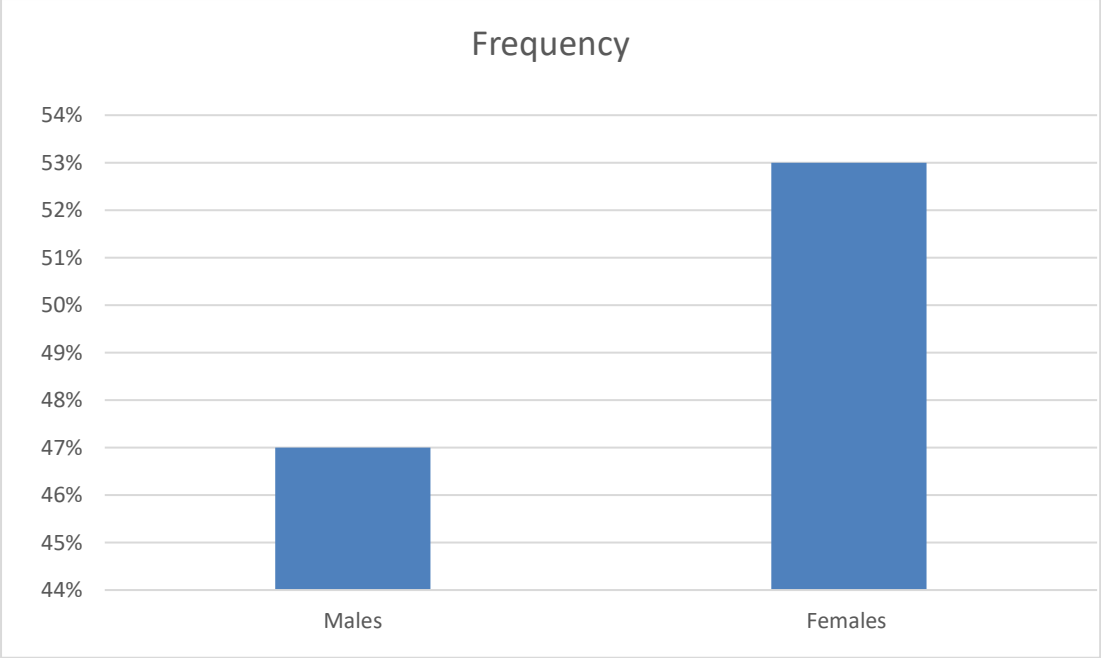


Figure 4.1: Gender of Grade Four Teachers

The involvement of 15 female teachers and nine male teachers in the survey indicates a notable gender imbalance that could influence views on the implementation of a Competency-based Curriculum in mathematics (Eagly and Carli, 2003). This disparity may restrict the breadth of the combined findings and potentially impact the overall comprehensiveness of the study. It highlights the importance of adopting inclusive sampling strategies to ensure diverse perspectives are represented, thereby enhancing the validity and relevance of the results (Acker, 2006).

Table 4.2: Gender of Head Teachers

Gender	Frequency	Percent
Male	17	71
Female	7	29
Total	**24**	**100**

The distribution of school head teachers, with 29% female and 71% male, underscores the notable representation of women in leadership positions within Machakos sub-

county. This gender diversity has the potential to positively influence the implementation of a competency-based curriculum, as varied leadership can foster a range of perspectives and promote inclusive teaching approaches (Brady et al., 2020). Promoting gender diversity in educational administration can enhance collaboration and ultimately contribute to improved student performance in subjects like mathematics (Shields, 2021).

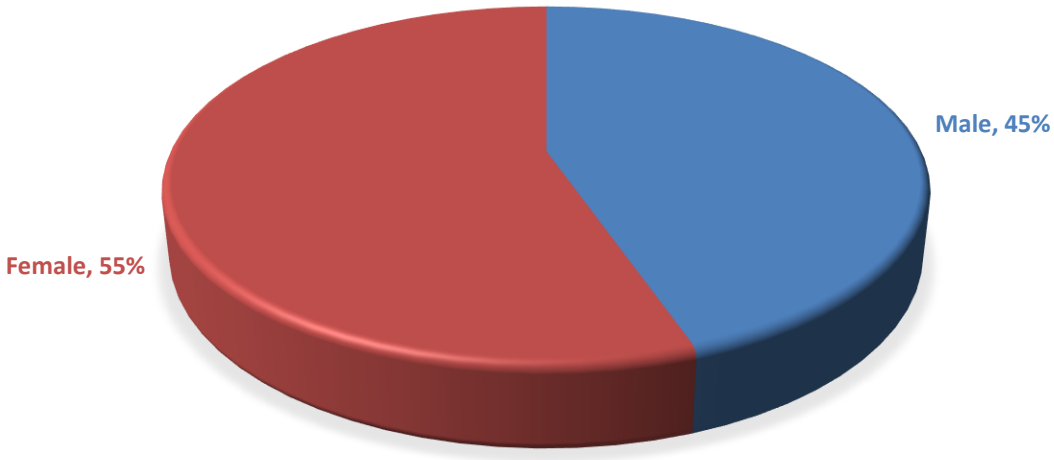


Figure 4.2: Gender of Pupils

The gender distribution of Grade 4 students in Machakos sub-county, with 55% female and 45% male, reflects a modest imbalance favoring female students. This demographic trend may influence classroom interactions and engagement with the curriculum, especially in mathematics, where gender stereotypes are commonly encountered (Stoet & Geary, 2018). Implementing targeted interventions and mentorship programs to encourage greater participation of girls in mathematics can enhance their performance and foster a more equitable learning environment (Sullivan et al., 2019).

4.3.2 Education Level of Participants

The study sought to establish the education level of grade 4 Mathematics teachers and head teachers enrolled into the study as shown in tables 4.3 and 4.4;

Table 4.3: Education Level of Grade 4 Teachers

Education	Frequency	Percent
Certificate	6	25.0
Diploma	9	37.5
Degree	9	37.5
Total	**24**	**100.0**

The above table indicates that the education level of grade 4 mathematics teachers is fairly spread between Degree (37.5%), Diploma (37.5%) and Certificate (25%).

Table 4.4: Education Level of Head Teachers

Education	Frequency	Percent
Diploma	9	37.5
Degree	15	62.5
Total	**24**	**100.0**

The educational qualifications of school head teachers in Machakos subcounty was clustered in two areas: Degree (62.5%) and Diploma (37.5%). This level of education was fairly adequate, for headteachers who were in charge of guiding curriculum implementation and enhancing teacher performance (Hallinger & Heck, 2010). Therefore, investing in the ongoing professional development of school head teachers is vital for the continuous improvement of the education system.

4.3.3 Mathematics Performance Levels of Pupils

The study sought to explore the extent to which the implementation of CBC affect performance in Mathematics among grade 4 pupils in public and private primary schools in Machakos Sub-County, Machakos County, Kenya

Table 4.5: Summary Scores

Gender of pupils	Average Mark	Minimum Mark	Maximum Mark
Boys	21.57	15	25
Girls	21.20	16	25

The average mathematics scores in Machakos Sub-County show boys (21.57) and girls (21.20), reflected similarity in performance levels. The score ranges, with minimums of 15 for boys and 16 for girls and maximums of 25 for both, indicate that most students perform within a narrow band, though outliers may influence the overall results (Sullivan et al., 2019). The mean performance is high, implying a possible boost due to the adoption of CBC. These findings highlight the importance of implementing harmonized adoption of CBC to meet diverse learning needs and promote equitable achievement in mathematics education (Baker et al., 2020).

4.4 Teachers Induction on CBC and the Performance in Mathematics

The study sought to establish the effect of teacher induction on CBC on Mathematics performance of grade 4 pupils in Machakos sub-county. Grade 4 teachers were asked to rate statements related to how their induction to CBC on a scale of 1-5 where; **1= Strongly Disagree (SD), Disagree, 3=Undecided (U), 4=Agree (A), 5=Strongly Agree (SA)**. Table 4.6 presents summary statistics.

Table 4.6: Summary statistics on Grade 4 Mathematics Teacher Induction on CBC

Variable	SD %	D %	U %	A %	SA %	Mean	Std. Deviation
The ministry conducted adequate induction on CBC curriculum.	25.0	0.0	25.0	25.0	25.0	3.25	0.50
The content of the induction program was adequate.	0.0	25.0	25.0	25.0	25.0	3.25	0.50
The frequency of induction was adequate.	25.0	25.0	25.0	25.0	0.0	2.10	0.00
The content of the induction program was relevant to the implementation of CBC.	0.0	25.0	0.0	25.0	50.0	4.50	0.58
The induction program has improved my skills and knowledge on implementation of CBC.	25.0	25.0	0.0	25.0	25.0	3.75	0.50

Mean: Strongly Disagree =1.00-1.80, Disagree =1.81-2.60, Not Sure=2.61-3.40, Agreed =3.41.4-20, Strongly Agree =4.21-5.00

The data presented in Table 4.6 reflects the perceptions of Grade 4 teachers in Machakos Sub-County, Kenya, regarding their induction on the Competency-Based Curriculum (CBC) implementation in mathematics. Notably, perceptions were mixed across various aspects of the induction program. For instance, 25% of respondents strongly disagreed on the adequacy of induction conducted by the ministry, 25% were undecided; thereby revealing concerns about the preparedness of educators. However, a significant 50% agreed that the content of the induction program was relevant to the implementation of CBC, which indicates a positive alignment between induction content and curriculum objectives. The program's impact on skill enhancement was also

acknowledged, with an equal distribution (25%) across "Strongly Disagree," "Agree," and "Not Sure." These findings suggest a need for continuous improvement in the induction processes, potentially by increasing frequency and expanding relevance to foster teacher confidence and competence in CBC implementation. Continued investment in professional development could enhance the quality of mathematics instruction among pupils (Bishop, 2022; Smith et al., 2021).

4.4.1 Thematic results on Teachers Induction on CBC and the Performance in Mathematics

The researcher conducted interviews among primary school head teachers to find out the extent of teacher induction in implementation of CBC. The head teachers were asked whether the teacher induction has helped the mathematics teachers in performance of mathematics. Qualitative interviews with head teachers revealed that, teachers' induction on the implementation of CBC was very instrumental and has made them competent and therefore better performance of the students in Mathematics. For instance, head teachers were asked the following question:

Has the teacher induction helped your teachers in the performance in Mathematics?

One head teacher argued:

> *"…Yes, they are well equipped with the right methodology and skills although in some topics the learners do not performs well."* (HT1)

Yet, another head teacher had this to say:

> *"...This induction is impacting well to the classroom teaching because this is refreshing hence improving the performance in mathematics. "*(HT2)

A head teacher had this to say:

> *"…Induction was very critical in helping teachers to acquire relevant skills for the new curriculum, and all these teachers studied the old 8.4.4 system."* (HT3)

Another head teacher stated:

> *"...Teachers need frequent training to effectively implement the Competency-Based Curriculum in mathematics instruction."*(HT4)

A head teacher added:

> "…. *We observed a marked improvement in pupils' problem-solving skills after CBC training for teachers."*(HT5)

A head teacher commented**:**

> *"...Parental involvement is crucial; fully engaged parents support their children's understanding of CBC math concepts".* (HT6)

Another head teacher said**:**

> *".... The Resources and materials available for teachers significantly impact how they teach mathematics under CBC*." (HT7)

Another head teacher posited:

> *"...With proper training, teachers can motivate students and make mathematics more engaging through CBC."*(HT8)

Qualitative findings of school principals on the impact of teacher induction on grade 4 students' performance in mathematics reveal strengths and areas for improvement in the implementation of a competency-based curriculum (CBC) in Machakos County, Kenya. Several principals acknowledged the positive impact of adaptation on teachers' methodology and skills. For example, HT2 noted a refreshing impact on classroom instruction, leading to improved student achievement in mathematics, while HT5 highlighted significant improvements in student problem-solving skills following the training. This is consistent with research findings showing that well-structured teacher

adaptation programs can increase teaching effectiveness and student achievement (Bill & Melinda Gates Foundation, 2019).

Conversely, HT1 and HT4 expressed concern about the need for frequent training and the fact that, despite the induction, some topics continued to challenge students' performance. This suggests a gap between theoretical training and classroom applications, suggesting the need for ongoing professional development to help teachers effectively address specific mathematical concepts. Additionally, HT6 and HT7 highlighted the importance of parental involvement and availability of resources in increasing the effectiveness of CBC. Parental involvement significantly supports children's understanding and application of mathematical concepts, as highlighted by Hart et al. (2020).

In addition, access to quality resources and materials directly affects teaching methods, facilitating a more engaging learning environment. Finally, HT8 stated that with appropriate training, teachers can better motivate students and increase their engagement in mathematics. This reflects the importance of teacher effectiveness in influencing student motivation and performance and reaffirms the essential role of teacher continuing professional development in achieving CBC goals. In conclusion, while the on boarding process positively impacted teachers' abilities to implement CBC, ongoing training, parent involvement, and access to resources are critical elements that can further improve math performance in grade 4 students.

4.5 Teachers Adoption of CBC Lesson Planning and the Performance in Mathematics

The study investigated the effect of teacher adoption of CBC lesson planning on Mathematics performance of grade 4 pupils in Machakos sub-county. Grade 4 teachers were asked to rate statements related to teacher adoption of CBC lesson planning on a scale of 1-5 where; **1= strongly Disagree (SD), Disagree, 3=Undecided (U), 4=Agree (A), 5=Strongly Agree (SA)**.

Summary results are shown in Table 4.7.

Table 4.7: Summary Statistics on Grade 4 Mathematics Teacher Adoption of CBC Lesson Planning

Variable	SD %	D %	U %	A %	SA %	Mean	Std. Deviation
I am able to develop schemes of work with all CBC aspects?	0.0	25.0	25.0	25.0	25.0	4.25	0.50
I am able to develop lesson plans with all CBC aspects?	0.0	25.0	25.0	25.0	25.0	4.25	0.50
I am able to identify specific learning outcomes in all lesson plans?	0.0	25.0	25.0	25.0	25.0	4.25	0.50
I have adequate learning resources in your lesson plans?	25.0	25.0	0.0	25.0	25.0	4.00	0.50

Mean: Strongly Disagree =1.00-1.80, Disagree =1.81-2.60, Not Sure=2.61-3.40, Agreed =3.41.4-20, Strongly Agree =4.21-5.00

The data in Table 4.7 provide insight into the adoption of Competency-Based Curriculum (CBC) by Grade 4 mathematics teachers in Machakos Sub-County, Kenya. The responses indicated a high level of agreement among teachers regarding their

ability to develop schemes of work and lesson plans that include all aspects of CBC, as evidenced by a mean score of 4.25 for both aspects. This is complemented by a consistent standard deviation of 0.50, indicating a uniform perception of teachers about their abilities. Further analysis reveals that 25% of teachers strongly agree and 25% agree with their ability to develop lesson plans. This observation is significant because identifying specific learning outcomes is critical to effective curriculum implementation. The literature emphasizes that clear learning outcomes enhance teaching quality and positively impact student performance (Lent & Brown, 2019).

However, the data shows a more mixed response regarding the adequacy of teaching resources in lesson plans, with 25% of respondents strongly disagreeing and 25% agreeing. This difference suggests that while teachers may be confident in their lesson planning skills, the availability of necessary resources remains an area of concern. The importance of adequate resources cannot be overstated, as access to appropriate materials directly affects teaching and student learning outcomes (Hattie, 2009). The overall data suggest those teachers' CBC lesson planning competencies are well established, supporting an optimistic view of student performance in mathematics.

However, the variability in resource availability suggests that stakeholders, including school administration and policy makers, need to improve support systems by ensuring the availability of appropriate learning resources like schemes of work and lesson plans. This is in line with the findings of Kaguong (2020) who emphasizes that effective resource allocation is essential for the successful implementation of new educational curricula. In conclusion, although the data indicate strong adoption of CBC lesson planning among Grade 4 mathematics teachers in Machakos sub-district, concerted

efforts are needed to address identified resource gaps. The implications of this study highlight the need for continued professional development for teachers and improved logistics to support effective instruction, with the ultimate goal of using the CBC framework to improve student achievement in mathematics.

4.5.1 Thematic Data on Teachers' Adoption of CBC lesson planning and the Performance in Mathematics

The researcher interviewed head teachers on the extent the mathematics teachers have adopted the new lesson planning strategies and its performance in Mathematics. The head teachers were asked if their teachers adopted new lesson planning strategies for quality performance in Mathematics? The head teachers said that all teachers in the surveyed schools had adopted lesson planning and teaching that is consistent with the CBC. The head teachers were asked:

Have your teachers adopted new lesson planning strategies for quality performance in Mathematics?

A head teacher said:

> *"…The teachers have adopted new lesson planning strategies to ensure quality performance in mathematic as a learning area in CBC."* (HT1)

Another teacher stated:

> *"…Teachers have accepted the CBC lesson planning framework quite well. They now focus on skills and competencies instead of just content coverage. This has undoubtedly improved how students engage with mathematics."* (HT2)

A head teacher posited:

> *"…Initially there was some resistance to the new lesson planning methods due to the long-standing 8-4-4 system. However, after consistent training and support, teachers are more confident, leading to higher student participation in mathematics."* (HT3)

A head teacher argued:

> *"....I have seen a remarkable transformation in the delivery of lessons. Teachers are now incorporating more hands-on activities that allow students to apply math concepts in real-world contexts, which has greatly improved their understanding."* (HT4)

Another head teacher said:

> *"...Adopting CBC lesson planning has not been easy, but those who have committed to it have reported improvements in student performance. The focus on problem solving and critical thinking skills is particularly encouraging."* (HT5)

A head teacher said:

> *".... There is a direct correlation between how well teachers plan their CBC lessons and student performance in math. Thoughtful lessons seem to engage students more effectively."* (HT6)

Another head teacher said:

> *".... Continuous feedback from teachers suggests that as they become more adept at planning CBC lessons, student performance in math improves. It's all about aligning instructional strategies with learning objectives."* (HT7)

A head teacher said:

> *"....Effective lesson planning within CBC has made mathematics teaching more dynamic. The results are clear – students not only perform better, but also develop a positive attitude towards the subject*." (HT8)

From the above data, the introduction of a Competency-Based Curriculum (CBC) in Mathematics for Grade 4 students in Kenya's Machakos sub-county has received positive feedback from school principals regarding the new lesson planning strategies adopted by teachers. These observations indicate a significant shift in pedagogic approaches that prioritize skills and competencies over mere content delivery, thus reinforcing the essence of CBC. HT1 and HT2 highlight teachers' transition to adopting strategies that more actively engage students in the learning process. This is consistent

with the findings of Muriungi (2020), who reported that effective lesson planning based on competency-based approaches increases student engagement and facilitates deeper understanding of mathematical concepts.

As HT3 points out, initial resistance stemming from the previously entrenched 8-4-4 system gradually decreased with continued training and support, leading to increased confidence among teachers. This transition reflects the importance of continuing professional development, as highlighted by Sibanda's (2021) study, which suggests that continuing education significantly supports teachers in adapting to the new curriculum. In addition, HT4 noted that teachers incorporate hands-on, real-world activities into their lessons, a practice supported by the literature advocating experiential learning as a strategy to improve understanding and application of mathematics (Brusilovsky & Millán, 2020). Such pedagogical changes contribute to richer learning experiences by allowing students to apply theoretical concepts in practical scenarios, as highlighted by HT5's mention of improvements in problem solving and critical thinking skills. Responses from HT6 and HT7 highlight the correlation between thoughtful lesson planning and improved student performance. This observation resonates with the work of Yoon et al. (2021) who found that lesson planning that aligns instructional strategies with specific learning objectives leads to better student achievement.

Furthermore, HT8 highlights the dynamic nature of teaching mathematics through CBC, noting not only academic improvements but also the promotion of positive attitudes towards the subject – a crucial aspect of lifelong learning. In summary, principals' reflections map a transformational path in mathematics education within the

CBC. Ongoing adjustments in lesson planning, support systems for teachers, and an emphasis on competency development work together to create a more effective learning environment. These findings underscore the importance of comprehensive teacher education, innovative teaching methods, and positive student engagement for improving mathematics performance.

4.6 Teachers adoption of CBC assessment methods and the Performance in Mathematics

The study sought to establish the effect of teacher adoption of CBC assessment methods on Mathematics performance of grade 4 pupils in Machakos sub-county. Grade 4 teachers were required to rank statements related to teacher adoption of CBC assessment methods on a scale of 1-5 where; 1= Strongly Disagree (SD), Disagree, =Undecided (U), 4=Agree (A), 5=Strongly Agree (SA). Results are presented Table 4.8.

Table 4.8: Summary statistics on Grade 4 Mathematics Teacher Adoption of CBC Assessment methods

Variable	SD %	D %	U %	A %	SA %	Mean	Std. Deviation
I am able to develop set assessment criteria (Rubrics).	0.0	0.0	25.0	50.0	25.0	4.25	0.50
I often follow the set assessment criteria.	0.0	25.0	25.0	25.0	25.0	3.50	1.00
I often refer and use of the assessment rubrics	0.0	25.0	0.0	50.0	25.0	3.25	1.50
I often report and notify learners of their achievement at a given time	0.0	0.0	25.0	25.0	50.0	4.50	0.58
I find it easy to use task completion strategy in assessing mathematical competence.	0.0	25.0	25.0	25.0	25.0	4.25	0.50
None of the assessment strategies is superior to the other.	0.0	25.0	0.0	50.0	25.0	3.75	1.26

Mean: Strongly Disagree =1.00-1.80, Disagree =1.81-2.60, Not Sure=2.61-3.40, Agreed =3.41.4-20, Strongly Agree =4.21-5.00

The data in Table 4.8 reflect the adoption of assessment methods within the Competency-Based Curriculum (CBC) by Grade 4 mathematics teachers in Machakos County, Kenya. Summary statistics illustrate strengths and areas for improvement in the assessment methods used by teachers. First, it is notable that 75% of teachers either agree (50%) or strongly agree (25%) with their ability to develop assessment criteria, specifically rubrics, for evaluating student performance, resulting in a high mean score of 4.25 and a low standard. a deviation of 0.50. This suggests a thorough understanding of how to apply structured assessment methods in line with CBC objectives that prioritize competence over rote learning. This assertion is supported by research by Black and Wiliam (2018), which highlights the effectiveness of formative assessment in improving student learning when clear criteria are established.

Conversely, when analyzing how teachers adhere to the established evaluation criteria, an average score of 3.50 shows milder agreement, with 25% of respondents strongly disagreeing and another 25% agreeing. The variation (standard deviation 1.00) highlights the inconsistency in the application of these criteria, suggesting that although teachers are capable of creating assessment rubrics, their consistent use in practice may require further emphasis. This is consistent with the findings of Wiliam (2021), who notes that simply creating assessment tools is insufficient; the actual implementation of these guidelines is critical to student success. Regarding the use of assessment rubrics, a mean score of 3.25 indicates a rather tentative adoption, with only 25% of teachers strongly agreeing to their frequent use. This could point to a need for better training and resources to improve the integration of these tools into daily practice. In addition, there was a strong positive response (mean score of 4.50) to regular reporting of student achievement, suggesting that teachers engage in feedback mechanisms that are essential for student motivation and improvement (Hattie, 2009).

Teachers' perception that no assessment strategy is better than others (mean 3.75) highlight the need for a balanced approach to assessment. Emphasis on the use of different assessment methods enables a more comprehensive understanding of pupils' competences. In conclusion, although the data show a generally positive attitude towards the adoption of CBC assessment methods among 4th grade mathematics teachers, the variability in the use of these assessments suggests that professional development and ongoing support are essential. Extended training can ensure consistency in the effective use of assessment rubrics while promoting deeper engagement with a variety of assessment strategies, ultimately improving student achievement in mathematics.

4.6.1 Thematic results on teachers' adoption of CBC assessment methods and the Performance in Mathematics

The researcher also conducted interview to find out the best assessment strategies used by mathematics teacher in their schools and according to the qualitative interviews, teachers prefer different methods of assessment. There are those who prefer written, observation as well as other strategies. When asked the question;

Which is the best assessment strategy is mostly used by teachers your school? A head teacher had these to say:

> "*…Teachers have become more innovative with their assessment strategies within the CBC, yet we need to ensure that they are making full use of the rubrics developed for consistency*." (HT1)

A head teacher posited:

> "*….While the rubrics have been in place, I have noticed that teachers are not applying them consistently in their assessments, which is affecting our students' math performance*." (HT3)

Another head teacher added:

> *"....The introduction of CBC has motivated teachers to adopt different assessment methods, which I believe could be a game changer for students' understanding of mathematics." (*HT3)

A head teacher commented:

> *"....Reporting of student results has improved, but we still have gaps in the effective use of assessment rubrics in the classroom."* (HT4)

A head teacher argued:

> *"...Teachers report that they are confident in setting assessment criteria, however regular monitoring and support is essential to ensure consistency in mathematics assessments."* (HT5).

Another teacher stated:

> *"...I believe our teachers have embraced the task strategy, but we need to bridge the gap in their training on the effective use of assessment tools."* (HT6).

A head teacher added*:*

> *"....There has been a significant improvement in student performance as teachers have adopted CBC assessment methods, but we still have a long way to go to ensure that these methods are applied equally."* (HT7).

Another head teacher posited:

> *"....Student involvement in assessment feedback has been beneficial, but ensuring that all teachers use assessment rubrics consistently is critical to maintaining performance in mathematics."* (HT8)

Statements of school principals (HTs) regarding the implementation of competency-based curriculum (CBC) assessment methods reveal a mixed environment of adoption and effectiveness in improving fourth-grade students' mathematics performance in Machakos sub-district, Kenya. Several principals highlight the innovative spirit of teachers who adopt different assessment strategies within the CBC. For example, HT1 reports that teachers are becoming more innovative, which is consistent with the findings of Phelps and Leadbetter (2020), who argue that a diversified approach to assessment can foster deeper understanding in students. However, HT3 points to inconsistencies in the application of these developed rubrics, which is consistent with the research of Wiliam (2021), emphasizing that successful implementation of innovative methods is largely dependent on consistent application to realize potential benefits.

Although the development of rubrics is acknowledged, the observation of gaps in their effective use by HT4 companies suggests that while strategy formulation is essential, practical solutions are where the challenges lie. This view echoes the findings of Black

and Wiliam (2021), who argue that formative assessment produces better learning outcomes only when teachers are sufficiently trained to use it consistently. HT5 supports this idea and argues that ongoing monitoring and support is essential to promote consistency of assessment, thereby achieving the full potential of CBC. HT6 reflects the adoption of a task performance strategy and emphasizes the need for training in the effective use of assessment tools. This view is consistent with the research of Mourshed et al. (2014) which shows that teacher education significantly influences the successful application of assessment methods and highlights the need for capacity building initiatives.

Additionally, HT7 observes a significant positive shift in student performance related to CBC methods, which is promising. However, this must be tempered by the recognition that there are differences in the application of these methods, suggesting a need for uniformity in practice. Finally, HT8 emphasizes the importance of student involvement in the assessment process as beneficial and emphasizes that consistent use of rubrics across the teaching staff is critical to sustaining progress. This resonates with Chick's (2017) findings about the benefits of engaging students in their learning processes. In summary, although the adoption of CBC assessment methods has initiated positive changes in fourth-grade students' performance in mathematics, challenges remain with the consistent application of these methods. Targeted professional development, continuous monitoring and systematic support of teachers are necessary to achieve meaningful improvements. These efforts could bridge the gaps identified by school principals and contribute to the achievement of desired learning outcomes in mathematics.

4.7 Teachers Supervision and the Performance in Mathematics

The study also investigated the effect of Mathematics teacher supervision on Mathematics performance of grade 4 pupils in Machakos sub-county. Grade 4 teachers were asked to rate arguments associated with teacher supervision on a scale of 1-5 where; **1= Strongly Disagree (SD), Disagree, 3=Undecided (U), 4=Agree (A), 5=Strongly Agree (SA).** Results are presented Table 4.9.

Table 4.9: Summary Statistics on Grade 4 Mathematics Teacher Supervision

Variable	SD %	D %	U %	A %	SA %	Mean	Std. Deviation
No action is taken against teachers who don't attend the CBC induction programme.	50.0	0.0	25.0	25.0	0.0	2.25	1.50
In my school there is prompt supervision of the planning process.	0.0	25.0	0.0	25.0	50.0	4.50	0.58
In my school there is feedback on the quality of planning.	0.0	0.0	0.0	50.0	50.0	4.50	0.58
There is always positive feedback on the planning process.	25.0	0.0	0.0	50.0	25.0	3.25	1.50
No action is taken against teacher who does not plan lessons adequately.	25.0	50.0	0.0	0.0	25.0	2.50	1.73
An appropriate mentorship is given to teachers who have challenges in implementing CBC.	25.0	25.0	25.0	25.0	0.0	4.67	0.58

Mean: Strongly Disagree =1.00-1.80, Disagree =1.81-2.60, Not Sure=2.61-3.40, Agreed =3.41.4-20, Strongly Agree =4.21-5.00

Source: Author (2023)

Summary statistics on the supervision of Grade 4 mathematics teachers provide a critical view of the current state of teacher support and accountability in the context of

Competency-Based Curriculum (CBC) implementation in Machakos Sub-County, Kenya. The data reflect different principals' perceptions of the essential components of supervision necessary for effective curriculum delivery. A significant observation emerges regarding oversight of the planning process with a high mean score of 4.50 and a standard deviation of 0.58, indicating that half of the respondents strongly agree that there is immediate oversight. This finding is consistent with literature that emphasizes that systematic supervision is critical to successful curriculum implementation (Fullan, 2016).

Immediate feedback on planning quality also receives similar scores, indicating that the feedback loop is working adequately. Consistent quality feedback is essential to support pedagogical improvements, which is consistent with Hattie's (2009) view that feedback is one of the most powerful influences on student learning outcomes. Conversely, the lack of accountability is evident in the responses to the question regarding teacher attendance at CBC adaptation programs, where 50% of respondents strongly disagree that action should be taken against absentee teachers. This lack of enforcement weakens the foundation of accountability necessary for effective curriculum implementation. Such findings resonate with research by Darling-Hammond et al. (2017) who emphasize that accountability measures are integral to ensuring that teachers are adequately prepared and supported during curriculum changes. The low measures against teachers who do not plan adequately (mean 2.50) further underscore this point and indicate a gap that requires urgent attention.

The survey shows that while mentoring for teachers trying to implement CBC is valued (mean 4.67), this support appears to be limited as 25% of respondents are still unsure

or disagree about the adequacy of mentoring structures. Effective professional development initiatives should be structured to address the concerns highlighted and focus on both planning and instructional competencies (Keyes, 2020). In conclusion, while oversight and feedback mechanisms hold promise for improving planning processes in CBC implementation, significant challenges remain regarding accountability and adequate support structures for teachers. It is essential that school authorities introduce accountability measures and improve mentoring programs to support a stronger framework for the implementation of CBC, thereby improving fourth year pupils' performance in mathematics

4.7.1 Thematic Results on Teachers Supervision and the Performance in Mathematics

The study conducted qualitative interviews with the head teachers on issue of teacher supervision and the performance of students. Results show that teacher supervision is very central to the performance of the teacher in the classroom which ultimately translates into improved learning outcomes for the students. The head teachers were asked:

To what extent does teacher supervision influence students' performance of grade 4 pupils in Mathematics? The head teacher argued:

> "…*Effective supervision has been key in helping our teachers align their lesson plans with CBC requirements, which has significantly increased student engagement in mathematics."* (HT1)

Another headteacher added:

> *"....Although we strive for routine supervision, I have noticed that some teachers are still hesitant to fully adopt new assessment methods, which has an impact on overall performance in mathematics."(*HT2)

A head teacher said:

> *"....The feedback system we have works well; we provide teachers with constructive feedback that directly correlates with students' better understanding of mathematical concepts*." (HT3)

Another head teacher posited:

> *"....One challenge we face is ensuring consistency in supervision; not all teachers receive the same level of support, which can lead to different student outcomes in mathematics."*(HT4)

One of the head teachers commented*:*

> *"....We introduced regular mentoring sessions and I noticed a significant improvement in the teachers' approach to mathematics. This encouraged students to solve problems together."*(HT5)

A head teacher added:

> *"....The lack of accountability measures for teachers who do not attend CBC training programs is concerning; without proper oversight, the effectiveness of the mathematics curriculum is at risk."*(HT6)

Another headteacher said:

> *"....Although we have a quick planning oversight, I have noticed that some teachers are still reverting to traditional methods, which is not in line with the CBC's aims in mathematics."* (HT7)

Another head teacher said:

> *"...We have started to involve students more in assessment of learning and the results are promising. It is clear that when students are involved, their performance in mathematics improves significantly" (*HT8).

Qualitative data collected from school principals in Machakos sub-county provide critical insight into the effect of teacher supervision on grade four students' performance in mathematics within a competency-based curriculum (CBC). The responses highlight several key themes related to supervision practices, teacher engagement, and student performance. One of the main findings is that effective supervision plays a significant

role in improving teachers' adherence to CBC requirements, leading to increased student engagement in mathematics. As HT1 noted, structured supervision makes it easier for teachers to adapt to new curricula, which correspondingly improves the learning experience of students. This supports the findings of the study by Leithwood et al. (2004) who found that school leadership and supervision directly influence the quality of instruction and student achievement.

However, the data also reveal problems that prevent optimal surveillance. Several head teachers mentioned inconsistency in supervision practices (HT4) which led to differences in student achievement in different classes. This inconsistency undermines the fundamental goal of ensuring equal learning opportunities for all students, contradicting the findings of Robinson et al. (2008) that effective instructional leadership is critical to increasing student achievement through consistent support and guidance. In addition, the reluctance of some teachers to adopt new assessment methods (HT2) points to a gap that needs to be addressed through more robust professional development. HT6 underscores this point by highlighting the lack of accountability of teachers who do not fully engage in CBC training. Consequently, without proper checks and balances, the integrity and effectiveness of the mathematics curriculum is undermined, as reflected in studies highlighting the need for teacher accountability to sustain educational reforms (Darling-Hammond et al., 2017).

On a positive note, the introduction of regular HT5 mentoring sessions is an example of good practice in professional development. This is consistent with the findings of the Center for Public Education (2010), which promotes collaborative practices among teachers to improve pedagogical approaches. In addition, HT8 emphasizes the

importance of student involvement in the assessment process. This participatory approach fosters a sense of ownership among students that correlates positively with their performance, thus supporting research from the American Psychological Association (2007) that emphasizes student-centered learning. In conclusion, while effective teacher supervision significantly influences fourth grade students' performance in mathematics, issues such as inconsistent teacher support and involvement in the curriculum need to be addressed. Ensuring a consistent and supportive supervision framework combined with professional development and accountability mechanisms can optimize the benefits of a competency-based curriculum.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter provides summary of the findings, conclusions and policy recommendations. Limitations encountered in the course of the study and suggestion for further studies is also explained in the chapter.

5.2 Summary

This section provides a detailed summary of the major study findings well illustrated as per the four study objectives.

5.2.1 Teachers Induction on CBC and the Performance in Mathematics

The first objective sought to establish how Mathematics teachers' induction on CBC affects performance in Mathematics. Findings on Grade 4 teachers' perceptions of their inclusion in the Competency-Based Curriculum (CBC) in Machakos Sub-county reveal divergent views on the effectiveness of the programme. While some teachers expressed concerns about the adequacy of the training provided by the Department, a significant number of teachers recognized the importance of the content for CBC implementation. The in-service training program is considered effective in improving teacher skills, but there are still differences of opinion about its overall effectiveness, suggesting that improvements are needed to build more confidence and competence among educators in implementing CBC. Qualitative findings from school principals further underscore the mixed results of teachers who report on student performance in mathematics. Principals recognized the positive impact of CBC training on teaching methods and skill acquisition, which correlated with improved student achievement and problem-

solving skills. However, some principals noted persistent problems in certain mathematical concepts, indicating a gap between theoretical preparation and practical application in classrooms. Principals further emphasized the key role of parental involvement and access to quality resources in increasing the effectiveness of CBC. Engaged parents can significantly support their children's understanding and application of mathematical concepts, while available resources can facilitate more engaging teaching methods that encourage student engagement. In addition, principals noted that effective training allows teachers to motivate their students and increase their participation in mathematics. This shows how critical continuing professional development is to achieving CBC's goals. In summary, the adaptation program positively impacted teacher preparedness; ongoing training, active parent involvement, and better access to resources are critical to further improving math outcomes for 4th graders. These elements are necessary to enrich the learning environment and to support success in implementing the CBC framework.

5.2.2 Adoption of CBC Lesson Planning and Mathematics Performance

The second objective sought to examine the effect of adoption of CBC lesson planning strategies on the performance of Mathematics among grade 4 pupils. Findings regarding the adoption of Competency-Based Curriculum (CBC) by Grade 4 mathematics teachers in Machakos Sub-county indicate a strong ability of teachers to develop comprehensive schemes of work and lesson plans. Teachers believe that they effectively incorporate various aspects of CBC, especially in creating specific learning outcomes that are key to successful curriculum implementation. This confidence is reflected in a generally favorable environment for CBC adoption. However, there are concerns about the adequacy of available teaching resources to deliver lessons. Despite

teachers' lesson planning abilities, gaps in resource availability highlight a critical area for attention. Appropriate materials are essential because they directly affect the quality of teaching and student learning outcomes. The data indicate a well-established competency of teachers in lesson planning, which supports optimism about student performance in mathematics. However, addressing the lack of resources should be a priority for stakeholders to increase the effectiveness of teaching. Feedback from school principals reinforces positive shifts in pedagogical approaches among teachers, emphasizing skills and competencies over rote memorization. Principals have noted increased student engagement and confidence among teachers, due to ongoing training and support in adapting to the new curriculum. This transition demonstrates the importance of professional development in facilitating change. Additionally, principals have found that teachers incorporate hands-on activities and real-world applications into their lessons, which improves students' understanding and application of math concepts. Aligning lesson planning with specific learning objectives has been associated with improved student performance, which promotes not only academic improvement but also positive attitudes toward mathematics. In summary, while the adoption of CBC in mathematics education shows promise, particularly in lesson planning and pedagogical innovation, addressing resource gaps and maintaining sustained teacher support are critical to maximizing student achievement in the subject.

5.2.3 Adoption of CBC Assessment and Performance of Mathematics

The third objective sought to establish how Mathematics teachers' adoption of new CBC assessment strategies affects performance. Findings on the adoption of Competency Based Curriculum (CBC) assessment methods by Grade 4 mathematics teachers in Machakos Sub County highlight both strengths and challenges. Teachers

generally demonstrate a strong ability to develop assessment criteria, particularly rubrics, indicating a good understanding of structured assessment in line with CBC objectives. However, even when teachers express the ability to create these rubrics, there is considerable inconsistency in their actual application in classrooms. This variability suggests that creating assessment tools alone is insufficient and highlights the need for ongoing practical training and support. The use of rubrics is tentatively accepted among teachers and points to potential barriers to incorporating these tools into everyday teaching practice that could be addressed through better training and resourcing.

Teachers reported that they actively engaged in regular reporting of student achievement, emphasizing their commitment to using feedback mechanisms that play a critical role in student motivation and performance. Interviews with school head teachers revealed a mixed environment in the adoption of CBC assessment methods. While some headteachers noted teachers' innovative approaches to assessment, there were concerns about inconsistency in the use of developed rubrics. This highlights the mismatch between strategy formulation and effective practical implementation, signaling the need for continuous professional development. In addition, there is recognition of positive shifts in student performance related to CBC assessment methods. However, differences in the application of these methods require greater uniformity in practice. Principals emphasized the importance of student involvement in the assessment process, and consistent application of the rubrics is seen as key to maintaining progress. In conclusion, while there are encouraging developments in the adoption of CBC assessment methods, targeted professional development and

systematic teacher support are essential to enhance the effective implementation of these strategies, which ultimately improves student achievement in mathematics.

5.2.4 Teachers Supervision and Performance in Mathematics

Objective four of the study sought to establish how the supervision on the implementation of CBC affects performance in Mathematics among Grade 4 pupils. Findings on the supervision of Grade 4 mathematics teachers in Machakos Sub County highlight the critical aspects of teacher support and accountability in implementing a competency-based curriculum (CBC). Teachers receive remarkable supervision during the planning process, suggesting that systematic supervision is integral to effective curriculum delivery. There is also feedback on the quality of planning that suggests feedback that supports pedagogical improvement and student learning outcomes. However, there is a significant lack of accountability, particularly with respect to teacher attendance at CBC adaptation programs, suggesting a lack of enforcement against absenteeism. This gap undermines the basic accountability needed for successful curriculum implementation. The survey further identifies the value placed on mentoring, although some respondents remain concerned about the adequacy of mentoring structures. Effective professional development initiatives must focus on strengthening teachers' planning and pedagogical competencies. Qualitative findings from school headteachers highlight the positive impact of effective supervision on teacher engagement in CBC, which in turn increases student engagement in mathematics. Structured supervision facilitates curriculum adaptation and contributes to a better student learning experience. However, problems such as inconsistent supervision practices and the resistance of some teachers to adopting new assessment methods prevent optimal results. Lack of accountability among teachers who do not

fully engage in CBC training is another significant issue that can undermine the integrity of the mathematics curriculum. The positive thing is that the regular mentoring meetings held by school headteachers represent an effective practice of professional development. Furthermore, encouraging student involvement in the assessment process cultivates a sense of ownership and positively influences performance. In summary, while effective teacher supervision plays a critical role in improving student achievement, addressing inconsistent support, professional development, and accountability is critical to maximizing the benefits of the CBC framework.

5.3 Conclusion

Following the findings, the study concludes that teachers in the 24 sampled schools in Machakos sub-county were adequately inducted on CBC. In addition, teacher's induction on CBC was very instrumental and therefore credited for better performance in Mathematics among grade 4 pupils.

The results of the study demonstrate that grade 4 Mathematics teachers in the surveyed schools have adopted new lesson planning and schemes of work under CBC. In addition, the study concludes that adoption of CBC is likely to enhance the quality of results in Mathematics.

The study has demonstrated that grade 4 Mathematics teachers in the surveyed primary schools have adopted various assessment methods as spelt out in the new CBC. In addition, the study shows that teachers have different opinion on the assessment methods depending on their preferences. However, the study has failed to demonstrate the link between the assessment methods adopted and the performance of Mathematics among grade 4 pupils.

The study concludes that teacher's supervision on the implementation of the CBC is very crucial. Supervised teachers are kept on their toes-this enhances their performance in class and the ultimate beneficiaries are the pupils through better performance.

5.4 Recommendations for policy and practice

Based on the findings, the study recommends that the Ministry of Education should;

1. Create comprehensive and ongoing professional development programs that focus not only on the theoretical aspects of the Competency-Based Curriculum (CBC) but also on practical application in the classroom. This should include practical training, workshops and peer mentoring to build confidence and competence among teachers to implement CBC effectively.
2. Ensure that schools have sufficient teaching resources and materials that are aligned with the CBC framework. Policymakers should prioritize allocating funds and resources to develop and distribute materials that support innovative teaching practices and pedagogical strategies necessary for effective mathematics instruction.
3. Implement robust accountability systems for teachers to ensure consistent participation in professional development programs and adherence to CBC standards. Regular monitoring and evaluation of teacher attendance and engagement in CBC training should be instituted to promote accountability among educators.
4. Encourage schools to actively involve parents and communities in the learning process, especially in mathematics education. This can include workshops, open days and other initiatives to educate parents on how they can

support their children's learning and how to implement CBC strategies at home.

5.5 Recommendations for Further Research

For future research, it is suggested studies be conducted on the underlisted subject;

1. Conduct studies to assess the long-term impact of CBC implementation on student achievement in mathematics. This research can help identify trends, challenges, and effective strategies over time, contributing valuable insights for curriculum improvement.
2. For further research, it is recommended to explore specific strategies and interventions that effectively increase parental involvement in their children's education, with a particular focus on mathematics. Additionally, understanding the impact of parental involvement on student performance within the Competency-Based Curriculum (CBC) can inform the development of targeted initiatives aimed at enhancing community support for education.
3. Conduct research to examine different models of supervision and mentoring in implementing CBC and determine which practices are most effective in increasing teacher performance and student achievement in mathematics. This can lead to the development of customized supervision frameworks that optimize teacher effectiveness and accountability

REFERENCES

Acker, S. (2006). Gendered education: Sociological perspectives. *Canadian Journal of Education*, 29(1), 257-259.

African Union. (2015). *Agenda 2063: The Africa We Want. Addis Ababa*: African Union.

African Union. (2016). *Continental Framework for the African Higher Education*. Addis Ababa: AU.

African Union. (2018). Agenda 2063: *The Africa We Want. Addis Ababa*: African Union.

American Psychological Association. (2007*). Principles for the effective assessment of learning.*

Amin, M. (2021). *Research Design and Methods in Education*. Oxford University Press.

Baker, D. P., & LeTendre, G. K. (2020). *National Differences, Global Connections: Conceptual Frameworks for Comparative Education*. Stanford University Press.

Boud, D., & Falchikov, N. (2006). Quantitative studies of student self-assessment in higher education: A critical analysis of findings. *Higher education*, *18*(5).

Bill & Melinda Gates Foundation. (2019). *Teachers Know Best: Teachers' Perspectives on Professional Development.*

Bishop, K. (2022). *Curriculum Development and Implementation*. Educational Press.

Black, P., & Wiliam, D. (1998). Assessment and classroom learning. Assessment in Education: *Principles, Policy & Practice, 5(1), 7-74.*

Black, P., & Wiliam, D. (2018). Classroom assessment and self-regulated learning: A new era of theory, research, and practice. *In E. J. C. F. Karabenick & D. H. Schunk (Eds.), Academic motivation and self-regulated learning (pp. 10-36). Routledge.*

Brady, K. L., Hatzichristou, C., & Olemoh, K. A. (2020). Gender diversity in educational leadership: Implications for practice. *Educational Management Administration & Leadership, 48(6), 981-998.*

Bransford, J., Brown, A. L., & Cocking, R. R. (2000*). How People Learn: Brain, Mind, Experience, and School*. National Academy Press.

Brusilovsky, P., & Millán, E. (2020). *User Modeling for Adaptive Hypermedia and Adaptive Educational System*s. Springer Nature.

Center for Public Education. (2010). *What research says about teacher mentoring*.

Chick, H. (2017). Student engagement in mathematics education: A study of the impact of student-centered practices on student learning and achievement. *Mathematics Education Research Journal, 29(4), 555-580.*

Cochran, W. G. (1977). Sa*mpling techniques.* Wiley & Sons.

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches.* Sage Publications.

Darling-Hammond, L. (2017). Teacher quality and student achievement: A review of state policy evidence. *Education Policy Analysis Archives, 25(5).*

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). Effective teacher professional development. Palo Alto, CA: Learning Policy Institute.

Dede, C., et al. (2016). *Transforming Education for the 21st Century: What it Means and How to Do It. Harvard University*.

Department of Basic Education. (2011). *Curriculum and Assessment Policy Statement (CAPS).* Government of South Africa.

EAC. (2020). *East Africa Education Strategy 2016-2020*. East African Community.

Eagly, A. H., & Carli, L. L. (2003). The female leadership advantage: An evaluation of the evidence. *The Leadership Quarterly, 14(6), 807-834.*

Elliott, V., & Nussbaum, M. (2016). Competency-based education: A critical review of the learning sciences. *Journal of Education Policy, 31(6), 755-771.*

Fowlen, S. (2014). *Assessment for learning: A guide for teachers*. Assessing Learning Publishing.

Fowler, F. J. (2014). Survey research methods. Sage Publications.

Fullan, M. (2016). *The New Meaning of Educational Change*. New York, NY: Teachers College Press.

Ghana Education Service. (2020). *National Education Sector Plan 2018-2030*. Ghana Education Service.

Gikunda, M. (2017). Implementation of Competency-Based Curriculum in Kenyan Primary Schools. *Kenyan Journal of Education, 45(2), 123-135.*

Gordon, L., & Noyes, A. (2021). The impact of teacher qualifications on student achievement: A review of the literature. *Education Economics, 29(4), 451 467.*

Guskey, T. R. (2002). Professional development and teacher change. *Teachers and Teaching: Theory and Practice, 381-8(3), 391.*

Hallinger, P., & Heck, R. H. (2010). Collaborative leadership and school improvement: Understanding the impact on school capacity and student learning. *School Leadership & Management, 30(2), 95-110.*

Harris, A., & Brown, M. (2018). Leadership for Curriculum Change. *Educational Leadership Review, 12(3), 45-60.*

Hart, R., Blatchford, P., & Kasari, C. (2020). Parental involvement in education and I impact on achievement: A meta-analytic review. *Educational Psychology Review, 32(2), 265-288.*

Hattie, J. (2009). Visible Learning: *A Synthesis of Over 800 Meta-Analyses on Achievement.* Routledge.

Ingersoll, R. M. (2001). Teacher turnover and teacher shortages: An organization analysis. *American Educational Research Journal, 38(3), 499-534*.

Johnson, R., Smith, L., & Lee, A. (2022). Enhancing Educational Research with Mixed-Methods Approaches. *Journal of Educational Research and Practice, 12(3), 45-62*.

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher, 33(7), 14-26.*

Kaguongo, W. M. (2020). Resource allocation and its influence on the implementation of the competency-based curriculum in Kenyan primary schools. *Journal of Education and Practice, 11(2), 22-27.*

Kenya Institute of Curriculum Development (KICD). (2019). *Curriculum Framework for Education and Training. Nairobi:* KICD.

Kenya Institute of Curriculum Development (KICD). (2020*). Competency-Based Curriculum*: Overview. Kenya Institute of Curriculum Development.

Keyes, C. (2020). The Role of Curriculum in Education Reform. *International Journal of Educational Policy, 8(1), 22-33.*

Kerlinger, F. N. (2003). *Foundations of behavioral research* (4th ed.). Harcourt College Publishers.

Killen, R. (2015). *Effective teaching strategies: Lessons from research and practice. South Melbourne*: Cengage Learning.

KNEC. (2021). *Kenya Certificate of Primary Education (KCPE) Report*. Kenya National Examinations Council.

Koch, A. J., D'Mello, S. D., & Jansen, R. (2015). A meta-analysis of the gender gap in academic self-efficacy. *Journal of Educational Psychology, 107(3), 893-906.*

Kothari, C. K. (2005). *Research Methodology; Methods and Techniques (2nd Edition).* New Age International Publishers: India

Koyan, E., & Ovworo, D. (2021). Impact of competency-based teaching strategies on students' performance in mathematics. *International Journal of Education Studies, 14(3), 145-159.*

Kumar, R. (2020). *Research Methodology: A Step-by-Step Guide for Beginners*. Sage Publications.

Lau, S., & Lim, K. (2018). Curriculum Innovation in Southeast Asia. *Asia-Pacific Journal of Education, 38(4), 505-520.*

Leithwood, K., Harris, A., & Hopkins, D. (2020). Five fuerte foundations for school leadership and effective practices. *Educational Management Administration & Leadership*, 48(5), 1000-1016.*

Leithwood, K., Seashore Louis, K., Anderson, S., & Wahlstrom, K. (2004). *How leadership influences student learning.*

Lent, R., & Brown, S. (2019). Career Development and Learning. *Journal of Vocational Behavior, 112, 100-112.*

Lievens, F., & Mulder, M. (2019*). Competency-Based Education and Training: Current Practices and Future Directions*. Routledge.

Lovat, T., Toomey, R., & Clement, N. (2020). *The Future of Education: Curriculum, Assessment and Learning.* Routledge.

Mbagaya, C. (2020). The impact of assessment strategies on students' performance in mathematics among primary school pupils: A case of selected schools in Kenya. *Global Journal of Educational Studies, 6(1), 45-58.*

MCEETYA (2008). A summary of the Melbourne Declaration on Educational Goals for Young Australians. *Ministerial Council on Education, Employment, Training and Youth Affairs.* Australia.

Mugisho, C. (2016). Challenges in Implementing Competency-Based Curriculum in Kenya. *Kenyan Educational Review, 20(2), 78-92.*

Mosha, H. J. (2012). *A case study of learning materials used to deliver knowledge and skills or competency-based curricula (in Tanzania).* Association for Development of Education in Africa (ADEA).

Mourshed, M., Chijioke, C., & Barber, M. (2014). *How the World's Most Improved School Systems Keep Getting Better*. McKinsey & Company.

Mugenda, O. M., & Mugenda, A. G. (2003). *Research methods: Qualitative and quantitative approaches*. Acts Press.

Mugo, F. W., & Kabiru, W. (2020). *Emerging trends in education: Implications for teaching and learning.* Educational Publishers

Musumba, B. (2021). The role of lesson planning in successful competency-based curriculum implementation in Kenya. *International Journal of Education and Research, 9(3), 27-38.*

Mutula, S. M., & Kyalo, D. (2018). *Information literacy in the digital age: New perspectives*. Oxford University Press.

Mwaura, P., Nyakwara, M., & Kagema, A. (2019). The impact of competency-based curriculum on mathematics performance in Kenya. *Journal of Education and Practice*, 10(6), 23-34.*

Mwoma, T., & Muthwii, J. (2020). Teacher Preparedness and Curriculum Implementation. *Journal of Education and Practice, 11(4), 45-56.*

Ngoya, A. (2021). The impact of competency-based curriculum on mathematics performance in primary schools. *Journal of Educational Research and Practice, 11(2), 45-58.*

Ocheing, V., & Nasasu, O. (2020).*Teaching and learning in post-modern societies.* Routledge.

Oduor, J. (2021). *Innovations in education: Strategies for improved learning outcomes.* Brilliant Publications.

OECD. (2018). PISA 2018 *Results: What Students Know and Can Do*. Paris: OECD Publishing.

OECD. (2019). Preparing *Our Youth for an Inclusive and Sustainable World*. Paris: OECD Publishing.

OECD. (2022). PISA 2022 *Assessment and Analysis Framework.* OECD Publishing.

Okebukola, A. (2016). Effectiveness of Competency-Based Curriculum in Primary Schools. *Nigerian Educational Research Journal, 4(1), 112-125.*

Omondi, J., & Abok, W. (2022*). Educational leadership in evolving contexts: Challenges and opportunities*. Cambridge University Press.

Omujuwa, O. (2017). Teachers' Perceptions of CBC in Nigeria. *African Journal of Educational Studies, 7(2), 89-101.*

Ondimu,S.M.(2018). *Teachers' preparedness for implementation of the Competency Based Currriculum in Private Pre-schools in Dagoretti North Sub-County,Nairobi City County*.University of Nairobi.

Onwuegbuzie, A. J. (2004). *Qualitative vs. quantitative research: A comparison of the debates.* Research in the Schools, 11(1), 30-34.

Orodho, J. A. (2018). Education and social transformation in Africa: A comparative analysis. Nairobi: Dynamic Publication.

Owojori, O. (2022). Teacher preparedness in implementing competency-based curriculum in Machakos Sub-County. *Kenya Journal of Education Studies, 4(1), 35-50.*

Phelps, R., & Leadbetter, J. (2020). Innovative approaches to teaching and learning in STEM. *International Journal of STEM Education, 7(1), 1-12.*

Piaget, J. (1973). *To Understand Is to Invent: The Future of Education*. Grossman Publishers

Reddy, V., et al. (2019). The effectiveness of a competency-based curriculum in mathematics: Lessons from South Africa. *Journal of African Education Studies, 6(1), 12-26.*

Robinson, V. M. J., Hohepa, M. K., & Lloyd, C. A. (2008). School leadership and student outcomes: Identifying what works and why.

Sahlberg, P. (2011). *Finnish lessons: What can the world learn from educational change in Finland*? Teachers College Press.

Shakeshaft, C. (1989). *Women in educational administration*. SAGE Publications.

Shields, C. M. (2021). *Transformative Leadership: A Framework for Social Justice*. SAGE Publications.

Sibanda, L. (2021). Professional development and teacher adaptation to CBC: Insights from Kenyan schools. *Journal of Curriculum Studies, 53(3), 348-366.*

Sifuna, D. N. (2020). Competency Based Curriculum in Primary Schools in Kenya: Prospects and Challenges of Implementation. *Journal of Education and Practice*.

Smith, J., Doe, A., & Lee, R. (2021). Innovations in Curriculum Design. *Journal of Educational Research, 115(3), 215-230.*

Stoet, G., & Geary, D. C. (2018). The gender-equality paradox in mathematics education. *Psychological Science, 29(3), 420-431*.

Suleiman, O. (2019). *Challenges in higher education: Strategies for success.* University Press.

Sullivan, P., McSaveney, R., & O'Shea, J. (2019). Gender equity in mathematics education: An action research approach. *Research in Mathematics Education*, 21(1), 22-37.*

UNESCO. (2015). *Education for Sustainable Development Goals: Learning Objective*s. Paris: UNESCO.

UNESCO. (2016). *Education for Sustainable Development Goals: Learning Objectives*. Paris: UNESCO.

UNESCO. (2021). *Global Education Monitoring Report 2021: The Role of Education in Sustainable Development*. UNESCO.

Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes.* Harvard University Press

Wafula, N. (2022). Teacher preparedness in implementing competency-based curriculum in Machakos Sub-County. *Kenya Journal of Education Studies, 4(1), 35-50.*

Wallace Foundation. (2016). *The Elements of Effective Leadership*. Wallace Foundation

Waweru, R., & Kihoro, J. (2021). The influence of teachers' training on the implementation of competency-based curriculum in primary schools in Kenya. *Educational Research International, 2021, 9995286*.

Wiggins, G., & McTighe, J. (2005). *Understanding by Design. Upper Saddle River,* NJ: Pearson Education.

Wiliams, D. (2021), "Assessment and Classroom Learning", Assessment in Education: *Principles, Policy and Practice, CARFAX, Oxfords hire, Vol. 5.*

World Bank. (2022). *Kenya's Competency-Based Curriculum: Progress and Challenges.* Washington, DC: World Bank Publications.

Yoon, K. S., Duncan, T., Lee, S. W., Scarloss, B., & Shapley, K. (2021). *Reviewing the evidence on how teacher professional development affects student achievement*. U.S. Department of Education, Institute of Education Sciences.

APPENDICES

Appendix I: Letter of Introduction

Daniel Mumo Nzioki

P.O Box 136-90100

Machakos

The Head teacher,

----------Primary

Dear sir/madam,

RE: PARTICIPATION IN DATA COLLECTION FOR RESEARCH PURPOSE

I am a post-graduate student at the Machakos University, pursuing Master's Degree in Education. I am undertaking research on the ***COMPETENCY BASED CURRICULUM IMPLEMENTATION AND THE PERFORMANCE IN MATHEMATICS AMONG GRADE 4 PRIMARY SCHOOL PUPILS IN MACHAKOS SUB-COUNTY, KENYA***. To achieve this, your school is among the ones that have been chosen for the research. You have also been identified to take part in this research. I am therefore seeking your permission and assistance to collect data from you by filling in/responding to the accompanying questionnaire/interview guide.

I reassure you that the details you give will be utilized only for educational purpose for which it is intended and will be treated with confidentiality.

Thank you in advance,

Yours faithfully,

Daniel Mumo Nzuki

Mobile No. 0725015412

Appendix II: Questionnaire for Grade 4 Mathematics Teachers

Dear respondent,

The researcher is a student undertaking a degree course in Master of Education in Education Communication and Technology in Machakos University researching **"Competency Based Curriculum implementation and the performance in Mathematics among Grade 4 primary school pupils in Machakos Sub-County, Kenya"**. The information provided will be confidential and entirely used for this study.

Section A: General Information

Instruction: Please tick against your most appropriate answer and fill the spaces provided.

1. Gender: Male [] Female[]

2. Highest level of educational qualification

   Certificate []

   Diploma []

   Degree []

   Postgraduate []

Section B: Extent of Teachers' induction on implementation of CBC and performance in Mathematics

Rate the extent to which Mathematics teachers have been inducted on implementation of Competency Based Curriculum and the performance in Mathematics. Use a scale of 1-5 where; 1 Strongly Disagree, 2 Disagree, 3 Undecided, 4 Agree, 5 Strongly Agree.

Test Item	**1**	**2**	**3**	**4**	**5**
The ministry conducted adequate induction for CBC curriculum					
The content of the induction program was adequate					
The frequency of induction was adequate					
The content of the induction program was relevant to the implementation of CBC					
The induction program has improved my skills and knowledge on implementation of CBC					

Section C: Extent of Mathematics teachers' adoption of new lesson planning strategies and performance in Mathematics

Rate the extent to which Mathematics teachers' have adopted new lesson planning strategies and the performance in Mathematics. Use a scale of 1-5 where: 1 Strongly Disagree, 2 Disagree, 3 Undecided, 4 Agree, 5 Strongly Agree.

Test Items	**1**	**2**	**3**	**4**	**5**
I am able to develop scheme of work with all CBC aspects					
I am able to develop lesson plans with all CBC aspects					

I am able to identify specific learning outcomes in all lesson plans					
I have adequate learning resources in my lesson plans					

D) Extent to which Mathematics teachers had embraced new assessment strategies and performance in Mathematics.

Rate the extent to which Mathematics teachers have embraced new assessment strategies and relationship to performance in Mathematics in your school. Use a scale of 1-5 where; 1 Strongly Disagree, 2 Disagree, 3 Undecided, 4 Agree, 5 Strongly Agree.

Test Items	**1**	**2**	**3**	**4**	**5**
I am able to develop set assessment criteria (Rubrics)					
I often follow the set assessment criteria					
I often use of the assessment rubrics					
I often report and notify learners of their achievement at a given time					
I find it easy to use task					
None of the assessment strategies is superior to the other					

E. Teacher Supervision on implementation of CBC and performance in Mathematics

Rate the extent to which supervision conducted by the Head of Department, Head teacher, Sub-County quality \Assurance officer and County Quality Assurance officer affects the performance in Mathematics. Use a scale of 1-5 where; ***1 strongly Disagree, 2 Disagree, 3 Undecided, 4 Agree, 5 strongly Agree.***

Test Items	**1**	**2**	**3**	**4**	**5**
No action is taken against teachers who don't attend the CBC induction programme					
In my school there is prompt supervision of the planning process					
In my school there is feedback on the quality of planning					
There is always positive feedback on the planning process					
No action is taken against teacher who does not lesson plan adequately					
An appropriate mentorship is given to teachers who has challenges in implementing CBC					

Appendix III: Interview Guide for Head Teachers

Dear Respondent,

The researcher is a student undertaking a degree course in Master of Education in Education Communication and Technology in Machakos University researching on **"Competency Based Curriculum implementation and the performance in Mathematics among Grade 4 primary school pupils in Machakos Sub-County, Kenya"**. The information provided will be confidential and entirely used for this study.

Section A: General Information

Instruction: Please tick against your most appropriate answer and fill the spaces provided.

1. Gender: Male [] Female[]
2. Highest level of educational qualification

   Certificate []

   Diploma []

   Degree []

   Postgraduate []

Section B: Induction of Teachers on CBC and Performance In Mathematics in among Grade 4 Pupils

1. Has the teacher induction helped your teachers in the performance in Mathematics?

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2. How is the induction helping in acquisition of skills and knowledge to the teachers?

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3. How is the induction of the new curriculum adequate to the teacher in your school?

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Section C: Adoption of New CBC Lesson Planning Strategies by Mathematics Teachers Affects Performance among Grade 4 Pupils

1. Have your teachers adopted new lesson planning strategies for quality performance in Mathematics?

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……

2. Have your teachers adopted new lesson planning strategies?

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……

……

Section D: Adoption of new assessment strategies and performance in Mathematics

1. Which is the mostly used assessment strategy by teachers your school

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2. Do teachers find it easy to adopt new assessment strategies

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Section E: Supervision of CBC Implementation and Performance In Mathematics

1. What are the challenges related in preparing schemes of work?

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2. What are the challenges related to lesson planning in your school?

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……

……

……

3. What are the challenges related to assessment faced in your school?

……

……

……

……

Appendix IV: Mathematics Competence Test

Grade 4 Mathematics activity - 2023

PUPIL'S NAME: _____

DATE: _____

SCHOOL NAME: _____

Instructions to the learners

1. This paper consists of **25** Questions.

2. Answer **all** the questions.

3. Show all the working in the spaces provided below each question.

Answer ALL the questions in the spaces provided

1. A factory packed 34897 bags of coffee. What is the total value of digit 4 in the number of bags packed with coffee?
2. A head teacher received 25 cartons of Mathematics textbooks. Each carton had 20 textbooks. How many textbooks did the head teacher receive altogether?
3. In an election, the winning candidate got 4775 votes while the other candidate got 3814 votes. How many votes did all the candidates get altogether?
4. The Kenya Forest Services donated 2687 tree seedlings to a school. Learners in the school planted 1251 tree seedlings on the first day. The rest of the tree seedlings were planted on the second day. How many seedlings were planted on the second day?
5. A hospital matron requested 3467 doses of a vaccine. She received 2725 doses of the vaccine. How many more doses of the vaccine will be required by the hospital?

6. There are 55 learners in a class at Keaa Primary School. During a Physical Education (P.E.) lesson, the teacher placed the learners in groups. Each group had 5 learners. How many groups of learners did the teacher form?

7. During a birthday party, 10 children shared a cake equally among themselves.

   What fraction of the cake did each child get?

8. The length of Naliaka's shadow is 1.345 metres. Which digit in the number represents the hundredths place value?

9. Juma sells mangoes. He sold 31 mangoes at sh 25 each. How much money, rounded off to the nearest sh 10 did he get?

10. Paul took 2 hours 15 minutes to cultivate a piece of land. How many minutes did he take to complete the job?

11. A motorist travelled from Kisumu to Nakuru using a matatu. He left Kisumu at 10 o'clock in the morning and took 3 hours. At what time in a.m/p.m did he arrive at Nakuru?

12. Hamisi has a sh 1000 note. She bought the following items:

A blanket for sh 340

A bucket for sh 250

A broom for sh 125

How much money did she remain with?

13. A shopkeeper bought 2250 kg of sugar. On a certain day, he sold 1845 kg of sugar. How many kilograms of sugar remained?

14. Mary drew a plan of her garden and divided it which measures 35m by 50m. Find the area of the garden is _____ × _____ = _____ square metres.

15. A teacher had ***p*** pencils. She gave 8 pencils to learners in her class. Write an expression to show the number of pencils the teacher remained with.

16. The teacher has provided you with water or sand, a small container labelled **A** and a large container labelled **B**. Fill the small container completely with water or sand and pour it in the larger container. Repeat the process until the larger container is full of water or sand. How many times was container **A** used to completely fill container B with water or sand?

17. A tailor bought 72 metres of white cloth and 16 metres of blue cloth. The materials were cut into equal lengths to make a school uniform. What was the greatest length of each piece of cloth that was cut?

18. A dairy factory processed 645285 packets of milk in the first week. In the second week, 273094 packets of milk were processed. How many packets of milk were processed in the two weeks altogether?

19. A trader had 731945 bags of maize in a store. She sold 690583 bags of maize. How many bags of maize remained in the store?

20. A digital beam balance was used by a butcher to measure 5.876 kg, 5.798 kg, 5.789 kg and 5.892 kg of meat. Arrange the masses of meat from the smallest to the largest kilogram.

21. A bookseller recorded the number of books that remained in the store each day. The number of books that remained in the store for four days were 685380, 683880, 681880 and 679380 in that order. How many books remained in the store on the fifth day?

22. A farmer harvested 627 oranges. He packed the oranges equally in 3 boxes. How many oranges were in each box?

23. A lesson took 35 minutes 25 seconds. It was followed by a break of 10 minutes 46 seconds. How long did the lesson and the break take altogether?

24. A motorcyclist covered 7 kilometres 350 metres in a day. What is the distance covered in metres on that day?

25.Kamau bought four bottles of soda from a retail shop. He then added nine more soda bottles from mama waita's shop and finally added eight more sodas from mutheu's shop. How many bottles did kamau had all together?

Appendix V: Grade 4 Marking Scheme

Each question is awarded ONE mark.

Total marks 25.

Question	Answer	Question	Answer
1.	Total value of digit 4 is 4000	15.	Pencils remained were $\boldsymbol{p}-8$
2.	25×20=500 textbooks	16.	Container A will be used 4 times to completely fill container B
3.	4775+3814=8589 votes	17.	GCD of 72 and 16 is 8
4.	2687−1251=1436 tree seedlings	18.	645285+273094=918379 packets of milk
5.	3467−2725=742 doses of vaccine	19.	731945-690583=41362 bags of Maize
6.	55÷5=11 groups	20.	5.789 kg,5.798 kg,5.876 kg, and 5.892 kg of meat.
7.	Each child got 1/10	21.	685380+683880+681880+ 679380=2730520 books
8.	The hundredths place in the number 1.345 is 4.	22.	627÷3=209 oranges
9.	31×25=sh 775, rounded off to the nearest 10 is sh 780	23.	35:25+10:46=45:71-00:60=46mins 11 seconds
10.	(2×60) +15=135 minutes	24.	7 kilometres 350 metres=7000+350=7350metres
11.	10.00 $a.m$+3 $hours$=1.00 $p.m$	25.	4+9+8=21 bottles
12.	sh 1000−(340+250+125) =sh 285		
13.	2250−1845=405 kg		
14.	35×50=1750sq units		

Appendix VI: Budget

S/NO	ITEM	TOTAL
1	Printing papers	10000
2	Laptop	40000
3	Internet bundles	5000
4	Typing	6000
5	Printing	10000
6	Photocopying	10000
7	Binding	15000
9	Travelling, Meals and accommodation	30000
TOTAL		**Kshs 126,000.00**

Appendix VII: Work Plan

Activity	**Duration in months**
Problem identification and reviewing the related literature	January 2022
Proposal writing	April 2022
Submission of the proposal to the department guidance	October 2022
Defense	August 2023
Piloting research instruments and collection of data	January. 2024
Analyzing data and report writing	September. 2024
Report submission	June. 2025
Defense	August. 2025
Corrections and submission of final draft to graduate school	August. 2025

Appendix VIII: Research Letter: Machakos University

MACHAKOS UNIVERSITY
OFFICE OF THE DEAN GRADUATE SCHOOL

Telephone:254-(0)735247939, (0)723805929
Email: graduateschool@mksu.ac.ke
Website: www.machakosuniversity.ac.ke

P.O Box 136-90100
Machakos
KENYA

REF. MksU/ASA/GS/3/3

4th September, 2023

The Director,
National Commission for Science, Technology and Innovation,
P.O Box 30623,
NAIROBI.

Dear Sir,

RE: DANIEL MUMO NZUKI (E55/4619/2019)

The above named is a Masters student in the second year of study and has cleared course work. The University has cleared him to conduct a research entitled: **"Competency Based Curriculum Implementation and Performance in Mathematics among Grade 4 Primary School Pupils in Machakos Sub-County, Kenya."**

Kindly assist him with a Research Permit in order to undertake the research.

Thank you.

DEAN GRADUATE SCHOOL P.O. BOX 136 - 90100, MACHAKOS

04 SEP 2023

PROF. KIMITI RICHARD PETER, PhD
DEAN GRADUATE SCHOOL

KRP/gm

Appendix IX: Research Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **515966**

Date of Issue: **17/September/2023**

RESEARCH LICENSE

This is to Certify that Mr.. Daniel Mumo Nzuki of Machakos University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Machakos on the topic: Competency Based Curriculum Implementation And Performance In Mathematics Among Grade 4 Primary School Pupils In Machakos Sub-County, Kenya for the period ending : 17/September/2024.

License No: **NACOSTI/P/23/29517**

515966

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

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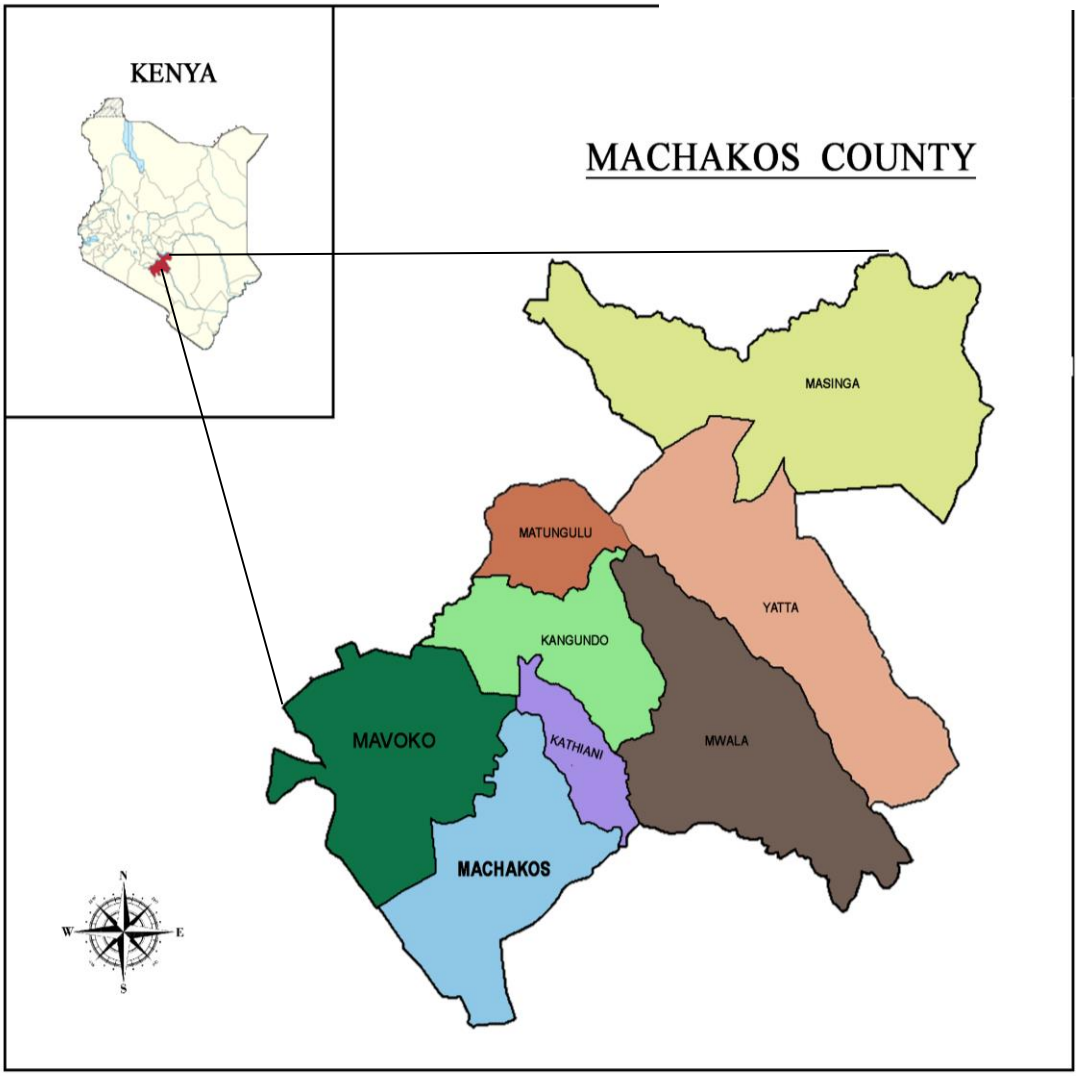
See overleaf for conditions

Appendix X: Map of Machakos County



Source: Google Maps